

Bull. Natn. Sci. Mus., Ser. A (Zool.), 6 (4), Dec. 22, 1980

The Anophthalmic Trechine Beetles of the Group of *Trechiana ohshimai*¹⁾

By

Shun-Ichi UENO

Department of Zoology, National Science Museum, Tokyo

Introduction

The genus *Trechiana* is the largest and most important of the trechine genera occurring in the Japanese Islands. Its members are widely known at present, but its status as a natural group is not necessarily clear and even the designation of its type-species has not been definitely settled. Since the latter problem has arisen mainly from the confusion in classifying the members of the species-group to which *T. ohshimai* and its direct relatives belong, I will commence this paper with a review of their earlier studies.

It was in the second volume of his classic monograph of Trechinae that JEANNEL (1927, pp. 115, 129, 141–143) erected *Trechiana* as a new subgenus of the grand genus *Trechus*. His original description was based on an imperfect male specimen of an anophthalmic trechine beetle deposited in PIC's collection, which he wrongly identified with *Trechus Oreas* H. W. BATES. In the same subgenus, JEANNEL also placed *Trechus Lewisi* (new name for *Trechus ovipennis* G. LEWIS), though he was unable to see any specimen of the species at that time. Thus, *Trechus oreas* sensu JEANNEL, 1927, nec H. W. BATES, 1883, was the only species actually involved in the establishment of *Trechiana*.

Describing blind trechines from Japanese limestone caves for the first time in 1951, I was not aware of the species studied by JEANNEL in preparing his description of *Trechiana*. However, I did know that my specimens were widely different from either of *T. oreas* and *T. lewisi*, both oculate, and gave one of the new species the name *Yosiitrechus ohshimai* (UENO, 1951, pp. 83–85). My error was soon detected by JEANNEL (1953, p. 128), who pointed out the close resemblance of my *ohshimai* to his *oreas* and suppressed *Yosiitrechus* as a junior synonym of *Trechiana*. On the other hand, he raised the latter not only to the generic rank but to the type-genus of a new phyletic series. In the following year, the same author obtained a paratype of *Trechiana oreas*, became aware of his former misidentification, and proposed the name *Trechiana angulicollis* for *Trechus Oreas* sensu JEANNEL, 1927 (JEANNEL, 1954, p. 12). Afterwards he altered his opinion in his revision of the Far Eastern Trechinae, plac-

1) This study is supported by the Grant-in-aid for Scientific Research No. 434039 from the Ministry of Education, Japan.

ing *T. angusticollis* (error for *T. angulicollis*) in a junior synonym of *T. ohshimai* (JEANNEL, 1962, p. 194). For some time, therefore, only the name *ohshimai* remained valid in the published data and automatically became the type of the genus *Trechiamia*.

JEANNEL was certainly right in placing *T. angulicollis* at the side of *T. ohshimai*, but the proposed synonymy of the two forms was subject to critical scrutiny. According to my own study, the two forms were decisively different in the shape of male genitalia in spite of their close similarity in external morphology. When JEANNEL's last account was published, however, it was difficult for me to decide whether the difference was specific or infraspecific, although I felt confident that *T. angulicollis*, a trechine beetle occurring in the immediate vicinities of Kyoto, should have been regarded as an example of an extraordinary differentiation if it really were a geographical race of *T. ohshimai*. Apart from the nomenclatorial sequence, *T. ohshimai* was obviously more advanced than *T. angulicollis*, so that from the phylogenetic viewpoint, the above conjecture could be considered reverse and *T. ohshimai* might be regarded as an extreme derivative of *T. angulicollis*. In any case, it was needed to gather as sufficient data as possible for clarifying the actual differentiation and distribution of these trechine beetles.

Even now, it cannot be said that all the taxonomic problems are definitely clarified concerning *T. ohshimai* and its direct relatives, which form the group of *T. ohshimai*. Other species belonging to the same species-group will doubtless be discovered still in future, especially in the area to the northeast of Lake Biwa-ko. This can be readily surmised from the fact that nine out of the twenty-two species hitherto known were brought to light in the first half of 1980, with the advancement in the technique of locating the exact habitats of endogean forms. However, I feel certain that I can give a fairly clear picture of this species-group now, and am going to publish the result of my protracted studies in the present paper.

The twenty-two species, of which only three were previously described, will be classified into five species-complexes, whose phylogenetic relationship will be clarified. In the "Notes" following the description of each species, the condition of its occurrence will be described at some length, wherever possible, on the basis of my own field experience, in the hope that this will encourage future collectors in making new findings. The differentiation and dispersal of these trechine beetles will be discussed and demonstrated, and the known localities of respective species will be shown on a sketch map, together with those of the neighbouring species belonging to the other groups of the genus. *Trechiamia angulicollis* will be revived beyond all reasonable doubt, so that the type-species of the genus *Trechiamia* will be definitely settled on this species.

The abbreviations used in this paper are as follows: HW — greatest width of head; PW — greatest width of pronotum; PL — length of pronotum, measured along the mid-line; PA — width of pronotal apex; PB — width of pronotal base; EW — greatest width of elytra; EL — greatest length of elytra; M — arithmetic mean; NSMT — National Science Museum (Nat. Hist.), Tokyo; MP — Muséum National d'Histoire

Naturelle, Paris; TS — Mr. Taichi SHIBATA's collection.

Before going into further details, I wish to express my hearty thanks first of all to Mr. Yoshiaki NISHIKAWA of Ohtemon-Gakuin University, Osaka, without whose indefatigable exertions in the field work, my study could never achieve the success as given in the present paper. My deep indebtedness is also due to the following colleagues and friends, whose kind aid and support enabled the completion of this paper: the late Professor René JEANNEL, Dr. A. DESCARPENTRIES, Dr. Gentaro IMADATÉ, Dr. Naomasa KOBAYASHI, Dr. Shûji OKAJIMA, Dr. Hiroyuki SASAJI, Dr. Riozo YOSHII, Mr. & Mrs. Minoru KATO, the late Mr. Nobuzane TAMU, Messrs. Akiyoshi AMAGASU, Hiromu ICHIHASHI, Hiroshi ISHIDA, Hiroshi IWASAKI, Mitsuru HIRAKE, Isamu HIURA, Yoshihiro HORI, Sumao KASAHARA, Kôjirô KATSURA, Ichiro KOJIMA, Gôji KISHIDA, Atsushi MATSUDA, Kazuo MORI, Yoshinobu MORIMOTO, Seiji MORITA, Hiroshi MIYAMA, Kiyoshi MIZUSHIMA, Satoru MIZUSHIMA, Akira NOTO, Yasuyoshi OKADA, Masataka SATÔ, Taichi SHIBATA, Kuniaki SUGA, Yuzo TARUMI, Osamu TOMINAGA, Shigeru WAKANO and Masahiko YOSHIKAWA.

Group of *Trechiana ohshimai*

Medium to large species, all depigmented and anophthalmic; body entirely glabrous on both the dorsal and ventral surfaces; inner wings absent.

Head with entire frontal furrows which are not angulate at middle; eyes vestigial, either not faceted or with imperfect ommatidia, their trace being always visible as a patch behind the insertion of each antenna; genae variable in convexity though always glabrous; labrum transverse, with the apical margin usually straight at the median part, sometimes widely emarginate; mandibles slender, arcuate, and sometimes sharply hooked; mentum free, with the tooth variable in shape, either simple, truncated at the tip or bifid; submentum always sexsetose; palpi slender, penultimate segments gently dilated towards apices, apical ones long subconical; antennae filiform and slender.

Pronotum usually cordate or subcordate, rarely subquadrate, with the sides always sinuate behind; hind angles usually sharp and salient, sometimes rectangular; marginal setae almost always complete, the posterior one present just before each hind angle except for *T. tenuiformis*; median line deeply impressed, deepening and widening in basal area and always reaching basal margin; apical transverse impression obsolete, sometimes vaguely wrinkled; basal transverse impression wide and shallow, almost continuous, with a foveole on each side of median line and laterally merging into basal foveae, which are more or less large, deep, usually smooth, and extend anteriorly; postangular carinae conspicuous, sharp and long; basal area narrow, usually with longitudinal rugosity.

Elytra oval or ovate, more or less elongate, with shoulders either distinct or effaced; striae usually shallow though always entire, impunctate, stria 8 deeply impressed behind the middle set of marginal umbilicate pores; scutellar striole always present, usually short but distinct; apical striole deeply impressed and not much

curved in front, usually joining or directed to stria 5 but sometimes joining stria 7; intervals smooth, apical carina distinct though usually obtuse; stria 3 with two setiferous dorsal pores before middle except for *T. inexpectatus*, in which the proximal pore is missing; stria 5 also with two setiferous dorsal pores, which are much more widely spaced than those on stria 3; preapical pore situated at the apical anastomosis of striae 2 and 3, behind the level of the terminus of apical striole, and always closer to suture than to apex; humeral set of marginal umbilicate pores aggregated, the four pores being ranged equidistantly.

Microsculpture of head distinct, largely consisting of transverse meshes; that of pronotum and elytra composed of fine transverse lines, though partially obliterated in many cases. Anal sternite provided with a pair of sexual setae in ♂, with two pair of them in ♀. Legs long and often slender; protibiae straight, gently dilated towards apices, longitudinally grooved on the external face and glabrous on the anterior face even at the apical part; tarsi thin, segment 4 with a long hyaline ventral apophysis in pro- and mesotarsi; in ♂, two proximal segments of each protarsus widely dilated, stoutly produced inwards at apices, and furnished beneath with sexual adhesive appendages.

Male genital organ variable in both size and shape, sometimes short and very small, sometimes elongate and very large. Aedeagus small, short and with wide flattened apical lobe in primitive species, large, elongate, gutter-shaped and with remarkably prolonged apical lobe in many of the derivative ones, hardly or only slightly arcuate at middle, and more or less curved at the basal part; basal orifice not particularly large, with the sides more or less distinctly emarginate; sagittal aileron present though sometimes very narrow or vestigial; inner sac usually provided with a thin anisotropic copulatory piece and one to three patches of sclerotized teeth, the latter of which are remarkably developed in derivative species. Styles variable, usually short and broad in primitive species, long and slender in derivative ones, each usually with four setae at apex though one of them is sometimes missing on one style or a fifth seta exceptionally occurs on one or both of the styles.

Range. Distributed in the areas surrounding Lake Biwa-ko, or the northern part of the Kinki District and the westernmost part of the Chûbu District in western Honshu, Japan. So far as is known, the distributional range of the species-group is limited by Awazu-onsen in Ishikawa Prefecture in the northeast, Neo-mura in Gifu Prefecture and the Suzuka Mountains in Mié Prefecture in the east, Shizushi-dô Cave in Kyoto Prefecture and Kogané-daké Hill in Hyôgo Prefecture in the west, Mt. Jubuzan in Kyoto Prefecture and the Minoo Hills in Osaka Prefecture in the south.

Notes. It is not easy to determine the derivation of this homogeneous species-group, whose members can be distinguished at first sight from the others. It may have originated from an offshoot of the group of *T. oreas*, which is an assemblage of the most primitive species of the genus widely distributed at present in northeastern Honshu and whose direct relatives occur in the central part of the Chûgoku District in western Honshu (group of *T. yokoyamai*) and on the high mountains of Taiwan (group

of *T. alatus*). The group of *T. ohshimai* is, however, evidently separated from them by the degeneration of eyes and the more advanced state of chaetotaxy. In these respects, it is identical with the monotypic group of *T. pluto* and that of *T. nakaoi*, which are narrowly localized in the Akiyoshi limestone area at the western end of Honshu and the northeastern corner of Kyushu, respectively. They may have been derived from a common ancestor with the group of *T. ohshimai*, but the direct relationship between them cannot be recognized at present as they are widely isolated from each other. On the other hand, the group of *T. oni*, whose members are distributed over the central and eastern parts of the Chûgoku Hills and the northeastern part of the Island of Shikoku, seems to have become differentiated from the group of *T. ohshimai* by losing a series (usually the internal one) of setiferous dorsal pores on elytra. Their distributional ranges are contiguous and partly interwoven with each other (cf. UÉNO, 1978 b, p. 293, and the accounts under the headings of *Trechiana ohshimai* and Discussion in the present paper).

The trechine beetles belonging to the group of *T. ohshimai* are very closely similar to one another in their external morphology, and though there are some that can be recognized at first sight, they can be classified with confidence only on their male genitalic features. This makes their identification rather troublesome. Fortunately, however, all the known species are allopatric, so that if a given specimen comes from a known locality, it can be determined without difficulty. It should be noted here that in the members of this species-group, the copulatory piece is, even if present, usually thin and hyaline and is concealed by large patches of heavily sclerotized teeth. Its presence can be easily overlooked unless the inner sac is carefully dissected and spread out. JEANNEL made this mistake when he described the male genitalia of his *Oreas* (= *angulicollis*) (1927, p. 144, fig. 527) and those of true *oreas* (1954, p. 13, fig. 2), and regarded the absence of copulatory piece as one of the key characters of the genus *Trechiana* (1962, p. 192). Actually, however, a differentiated copulatory piece exists in the aedeagi of both *T. angulicollis* and *T. oreas*.

Unlike the species belonging to the groups of *T. oreas* and *T. yokoyamai*, chaetotaxial aberrancy is only very exceptionally found in the members of the group of *T. ohshimai*. When the aberrancy occurs symmetrically, however, it may be difficult to place the aberrant specimen in its proper position unless carefully compared with other specimens from the same population. The occurrence of such aberrant individuals will be noted under the headings of respective species.

From the ecological view-point, these trechine beetles are primarily endogean in hilly countries. They usually live along the upper courses of narrow streams in temperate broadleaved or mixed forests, under large stones deeply embedded in the soil or in taluses deposited in shaded gullies. They tend to become cavernicolous wherever favourable caves or mine adits are available. Of the twenty-two species hitherto discovered, thirteen are strictly endogean, three have been obtained from both the endogean and hypogean habitats, and the remaining six have been known only from limestone caves or abandoned mine adits.

Key to the Species

The following key to the species belonging to the group of *Trechiamma ohshimai* is largely based on male genitalic features, and therefore, cannot be applied to females. However, I have been unable to design a better one, since many of the members of this species-group can be recognized only on the difference in the shape and structure of male genitalia. The illustrations inserted in this paper will be of help in the identification of given specimens.

- 1 (42) Elytral stria 3 with two setiferous dorsal pores; copulatory piece, if present, variable in shape but not saddle-shaped, lying on the right side of aedeagus; proximal teeth-patch of inner sac left lateral to dorsal, not ventral.
- 2 (5) Pronotum subquadrate; aedeagus very small, less than three-tenths as long as elytra, with poorly developed teeth-patches in inner sac.
- 3 (4) Elytra more elongate and parallel-sided; aedeagal apical lobe blunt at the tip; teeth-patches of inner sac composed of very small number of small teeth; copulatory piece absent; length 5.60–5.65 mm.....*T. subparallelus* sp. nov.
- 4 (3) Elytra shorter and less parallel-sided; aedeagal apical lobe with a sharp ventral hook at the tip; teeth-patches of inner sac larger, consisting of larger teeth; copulatory piece present; length 4.85–6.25 mm.....*T. sasajii* sp. nov.
- 5 (2) Pronotum more or less cordate; in case pronotum looks subquadrate rather than subcordate, aedeagus large, at least three-sevenths as long as elytra, and with large teeth-patches in inner sac.
- 6 (7) Pronotum very large, EW/PW 1.45 on an average; elytra elongate and almost parallel-sided; length 5.10–5.35 mm.....*T. grandicollis* sp. nov.
- 7 (6) Pronotum smaller, EW/PW more than 1.52 on an average; in case pronotum is exceptionally large, antennae long, extending obviously beyond the middle of elytra, and aedeagus at least three-sevenths as long as elytra, with two elongate teeth-patches on the left side of inner sac.
- 8 (39) Aedeagus either small, less than one-third as long as elytra, or large with narrowly prolonged apical lobe; inner sac usually with right apical teeth-patch in addition to large proximal one; in case apical teeth-patch is absent, proximal one does not extend onto the right lateral side of inner sac.
- 9 (10) Postangular seta of pronotum absent; body elongate and relatively parallel-sided; aedeagus fairly slender and gently arcuate; proximal teeth-patch of inner sac large and sigmoidally curved; length 4.85–5.55 mm.....*T. tenuiformis* sp. nov.
- 10 (9) Postangular seta of pronotum present.
- 11 (16) Aedeagus smaller, less than one-third as long as elytra, with apical lobe short, broad and almost symmetrical in dorsal view.

- 12 (15) Pronotum cordate, its base about as wide as apex; elytra shorter, widest at about or a little before middle; aedeagus relatively slender.
- 13 (14) Larger on an average; pronotal hind angles sharp and produced postero-laterad; aedeagus with longer apical lobe; proximal teeth-patch of inner sac larger, especially in basal half; copulatory piece absent; length 4.65–5.80 mm *T. nagahinis* S. UÉNO.
- 14 (13) Smaller on an average; pronotal hind angles either rectangular or somewhat sharp, usually not produced laterad; aedeagus with shorter apical lobe; proximal teeth-patch of inner sac composed of only a single row of teeth in basal half; copulatory piece present, twisted spatulate, with produced ventro-apical corner; length 4.20–4.75 mm
..... *T. parvus* sp. nov.
- 15 (12) Pronotum transverse subcordate, its base much wider than apex; elytra more elongate ovate, widest at about two-fifths from base; aedeagus short and robust, with large copulatory piece; length 4.50–5.10 mm.....
..... *T. tsurugaensis* sp. nov.
- 16 (11) Aedeagus larger and more elongate, more than three-eighths as long as elytra, with apical lobe narrowly prolonged and usually inclined to the left in dorsal view.
- 17 (22) Aedeagal apical lobe dorso-ventrally thickened at the extremity and in dorsal view, usually dilated at apex; lateral walls of aedeagus not reduced.
- 18 (21) Apical part of copulatory piece not arcuate.
- 19 (20) Pronotum more transverse, PW/PL 1.17 on an average; elytra narrower and more elongate, EW/PW 1.60 on an average; aedeagus more elongate; copulatory piece asymmetrically spatulate, with pointed ventro-apical corner; length 5.40–6.10 mm
..... *T. angulicollis* JEANNEL.
- 20 (19) Pronotum less transverse, PW/PL 1.08 on an average; elytra broader and shorter, EW/PW 1.74 on an average; aedeagus shorter; copulatory piece narrow, sagittate, with very narrow rod-like apical part; length 5.20–5.90 mm *T. rotundipennis* sp. nov.
- 21 (18) Copulatory piece very narrow, its apical part forming a very slender prolongation strongly arcuate ventrad; aedeagal apical lobe long and narrow, widely dilated at apex; length 5.90–6.10 mm.....
..... *T. mahoae* sp. nov.
- 22 (17) Aedeagal apical lobe either dorsally denticulate or distinctly reflexed at the extremity, but not thickened on the ventral side, and in dorsal view, not dilated at apex.
- 23 (26) Aedeagus with very flat apical lobe, which is dorsally denticulate at the extremity, and without preapical convexity on lateral walls; copulatory piece twisted.
- 24 (25) Aedeagal lateral walls not reduced; apical lobe broader in dorsal view;

- proximal teeth-patch of inner sac not sigmoidally curved; elytra usually with broader basal part and more salient shoulders; length 5.40–5.95 mm *T. applanatus* sp. nov.
- 25 (24) Aedeagal lateral walls evidently reduced; apical lobe narrower in dorsal view; proximal teeth-patch of inner sac sigmoidally curved at the apical part; elytra usually with narrower basal part and less salient shoulders; length 4.75–6.10 mm *T. canalatus* sp. nov.
- 26 (23) Aedeagus with more or less reduced lateral walls, which have a distinct convexity at least on the left side of apical orifice; apical lobe reflexed at the tip; copulatory piece, if present, more or less spatulate.
- 27 (32) Aedeagus smaller and shorter, less than three-sevenths as long as elytra.
- 28 (31) Proximal teeth-patch of inner sac round in lateral view, not sigmoidally curved; copulatory piece larger.
- 29 (30) Elytra shorter, with narrower basal part; aedeagus shorter, with lateral walls less reduced especially in basal half; copulatory piece with pointed or produced ventro-apical corner; length 4.85–6.10 mm *T. brevior* sp. nov.
- 30 (29) Elytra more elongate, with broader basal part; aedeagus more elongate, with more reduced lateral walls; copulatory piece not pointed nor produced at the ventro-apical corner; length 5.85–6.35 mm *T. insularis* sp. nov.
- 31 (28) Proximal teeth-patch of inner sac elongate in lateral view and sigmoidally curved at the apical part; copulatory piece much smaller; length 5.30–5.60 mm *T. intermedius* sp. nov.
- 32 (27) Aedeagus larger and more elongate, about a half as long as elytra.
- 33 (38) Copulatory piece present, always with sharp apex (or ventro-apical corner); aedeagal apical lobe longer; proximal teeth-patch of inner sac sigmoidally curved.
- 34 (35) Aedeagus very flat, with smaller basal bulb; proximal teeth-patch of inner sac smaller; length 5.60–5.80 mm *T. gracilior* sp. nov.
- 35 (34) Aedeagus less flat, with larger basal bulb; proximal teeth-patch of inner sac larger, consisting of very large teeth.
- 36 (37) Aedeagus with less reduced lateral walls; apical lobe broader in dorsal view and only briefly reflexed at the tip; inner sac with heavily sclerotized left apical teeth-patch; length 5.35–6.05 mm *T. sigma* sp. nov.
- 37 (36) Aedeagus with much reduced lateral walls; apical lobe narrower in dorsal view and remarkably reflexed at the tip; inner sac without left apical teeth-patch; length 5.20–6.10 mm *T. ohshimai* (S. UÉNO).
- 38 (33) Copulatory piece absent; aedeagus very flat, with apical lobe shorter, dorsally bent and remarkably reflexed at the tip; proximal teeth-patch of inner sac

- narrow and simply curved, not forming a sigmoid; length 5.20–6.10 mm
 *T. inermis* sp. nov.
- 39 (8) Aedeagus large, more than three-eighths as long as elytra, with very short symmetrical apical lobe; inner sac without right apical teeth-patch.
- 40 (41) Elytra oval, without distinct shoulders and with very oblique prehumeral borders; aedeagus smaller and shorter, about three-eighths as long as elytra; inner sac with a single, very large teeth-patch extending from left proximal to right apical sides; copulatory piece rounded at apex, lying near apical orifice; length 5.50–5.80 mm
 *T. spinosus* sp. nov.
- 41 (40) Elytra ovate, with distinct shoulders and less oblique prehumeral borders; aedeagus larger and more elongate, three-sevenths to four-ninths as long as elytra; inner sac with two elongate teeth-patches on the left side; copulatory piece pointed at the ventro-apical corner and widely distant from apical orifice; length 4.95–6.05 mm
 *T. suzukaensis* sp. nov.
- 42 (1) Elytral stria 3 with a single setiferous dorsal pore; aedeagus large and short, with very large basal bulb; copulatory piece very large, saddle-shaped, lying obliquely at the dorsal side; proximal teeth-patch of inner sac ventral, consisting of long spines compactly set together; length 4.55–5.40 mm *T. inexpectatus* sp. nov.

***Trechiana* (s. str.) *subparallelus* S. UÉNO, sp. nov.**

[Japanese name: Awazu-mekura-chibigomimushi]

(Figs. 1–3)

Length: 5.60–5.65 mm (from apical margin of clypeus to apices of elytra).

Fairly large species of subparallel habitus, with large fore-body and elongate elytra. Colour brown, more or less reddish, shiny, very faintly iridescent on elytra; palpi, scape and apical segments of antennae, and legs yellowish brown.

Head relatively large, subquadrate, about as wide as long, and depressed above, with frontal furrows rather shallow and moderately divergent in front and behind; frons, supraorbital areas and genae feebly convex; neck wide, with the anterior constriction shallow and not sharply marked; labrum only shallowly emarginate at apex, which is widely straight at the median part; mandibles slender, feebly arcuate even at the apical portions; mentum tooth porrect, distinctly bifid at the tip; antennae relatively short, hardly reaching the middle of elytra even in ♂, with segment 2 about two-thirds as long as segment 3, which is somewhat longer than segment 4, segments 8–10 each fully three times as long as wide, terminal segment about 1.5 times as long as but obviously narrower than scape and about as long as or slightly shorter than segment 3.

Pronotum subquadrate and moderately convex, much wider than head, a little

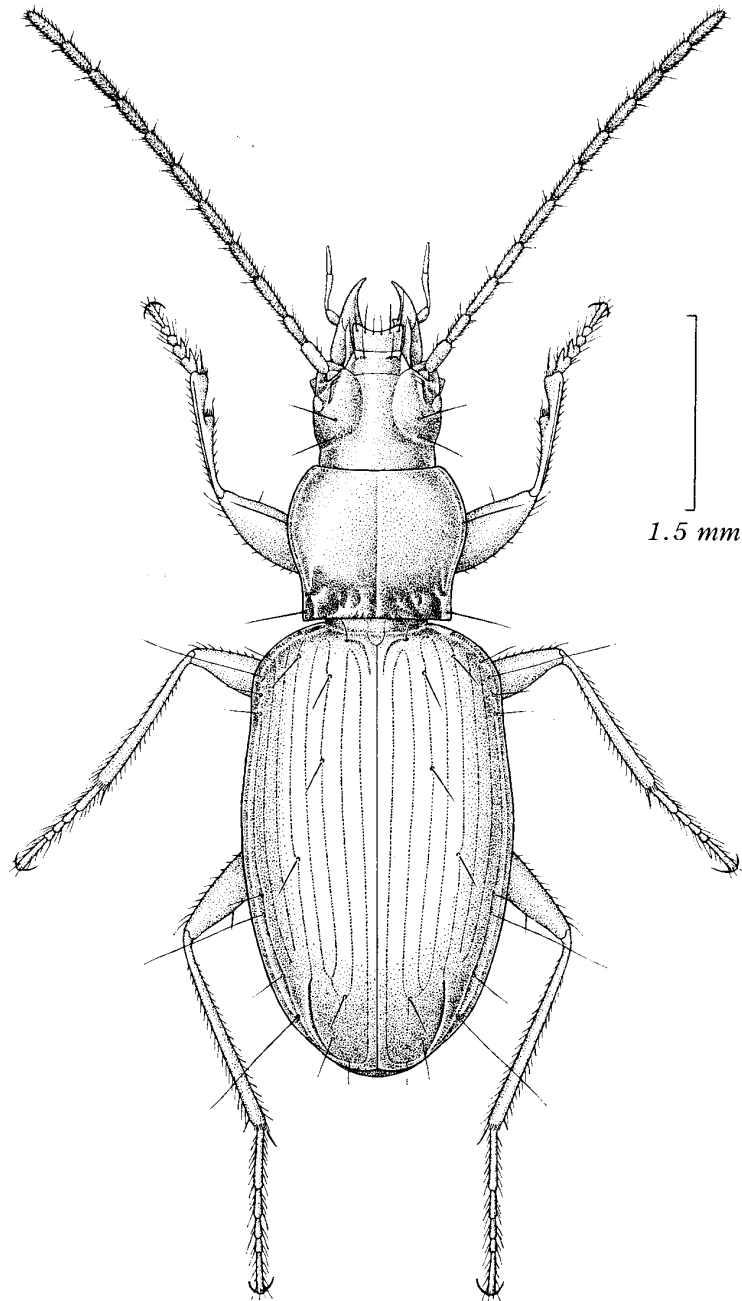


Fig. 1. *Trechiamma* (s. str.) *subparallelus* S. UÉNO, sp. nov., ♂, from Awazu-onsen.

wider than long, widest at about two-thirds from base, and more strongly contracted towards apex than towards base; PW/HW 1.43–1.45, PW/PL 1.11–1.14, PW/PA 1.46–1.48, PW/PB 1.20; sides widely and rather feebly arcuate in front, shallowly sinuate at about one-fourth from base, and then subparallel towards hind angles, which are nearly rectangular; apex slightly emarginate, obviously narrower than base, which is almost straight, PB/PA 1.22–1.24, with front angles very obtuse and hardly

produced; basal transverse impression very shallow, mal-defined and largely included in large basal foveae.

Elytra elongated ovate, widest slightly before the middle though almost parallel-sided, with fairly broad basal area; EW/PW 1.52–1.57, EL/EW 1.65–1.67; surface convex though gently depressed on the disc; shoulders distinct, with prehumeral borders feebly arcuate and not so oblique; sides narrowly bordered throughout, slightly emarginate behind shoulders, very weakly but widely arcuate at middle, and then moderately rounded to apices from behind the level of the seventh pore of the marginal umbilicate series; preapical emargination slight; apices rather narrowly and almost conjointly rounded, though forming a very small re-entrant angle at suture; striae relatively deep, especially on the disc, and moderately crenulate, even stria 7 being clearly impressed throughout; both scutellar and apical striae relatively long and deep, the latter joining stria 5 without interruption; stria 3 with two dorsal pores at about 1/8 and 1/3 from base respectively, stria 5 also with two dorsal pores at 1/14–1/12 from base and about middle, the proximal one being very close to the base.

Legs relatively short and stout within the species-group.

Male genital organ very small and rather poorly sclerotized. Aedeagus only two-sevenths as long as elytra, not arcuate at middle but gently expanded in apical half, with the basal part relatively narrow and feebly curved ventrad; basal orifice with deeply emarginate sides; sagittal aileron large and moderately sclerotized; viewed laterally, apical lobe rather thick, gently curved ventrad and blunt at the extremity, with the ventral edge minutely tuberculate on either side of longitudinal ventral concavity; viewed dorsally, apical lobe subtriangular, being very broad at the base and rapidly narrowed towards the blunt extremity; ventral margin slightly convex at middle in profile. Inner sac armed with three groups of sclerotized teeth or scales, of which the right apical one is the largest and the left proximal one is the smallest; the right apical group lies on the dorsal side near apical orifice and is divided into two portions, apical and proximal, the former consisting of heavily sclerotized teeth, while the latter of rather poorly sclerotized scales; the second group consists of five large teeth, lying at the left side of and ventral to the proximal portion of the right apical group; the left proximal group lies at the middle of aedeagus and consists of two or three large scales; copulatory piece not differentiated, though the right side of the proximal portion of the right apical group of scales forms a sclerite of indefinite shape. Styles broad, left style obviously larger than the right, each provided with four short setae at apex.

Female unknown.

Type-series. Holotype: ♂, paratype: 1 ♂, 23-X-1953, Y. OKADA leg. (NSMT).

Type-locality. Awazu-onsen, 50 m alt., in Komatsu-shi of Ishikawa Prefecture, on the Japan Sea side of the Chûbu District, Central Japan.

Notes. This is no doubt the most primitive of all the known species of the group of *T. ohshimai*. Its body form is peculiarly subparallel, mainly due to the large fore-body not so contracted as in the derivative species and to the relatively narrow hind

body. Its aedeagus is very small, short and of primitive structure; the apical lobe is not modified, the copulatory piece is not differentiated, and even the teeth-patches are not developed. It seems to be an endogean species, occurring at the northeastern periphery of the distributional range of the species-group. Of course, this does not mean that the group of *T. ohshimai* arose in the Hokuriku Province and dispersed southwestwards into the northern part of the Kinki District. *Trechiamma subparallelus* had better be regarded as a descendant of an old immigrant, surviving in isolation without undergoing much modification.

The two known specimens of this interesting species are said to have been taken on a low hill at the back (south) of Awazu-onsen. The spot at which the beetle was found was a gully near a paddy field only 50 m above sea-level. It was not an endogean habitat as the specimens were taken from under fist-sized stones, but this might not be the ordinary way of their occurrence. The trechine beetle may normally live deep in the soil, though it has never been met again since its discovery.

***Trechiamma* (s. str.) *sasajii* S. UÉNO, sp. nov.**

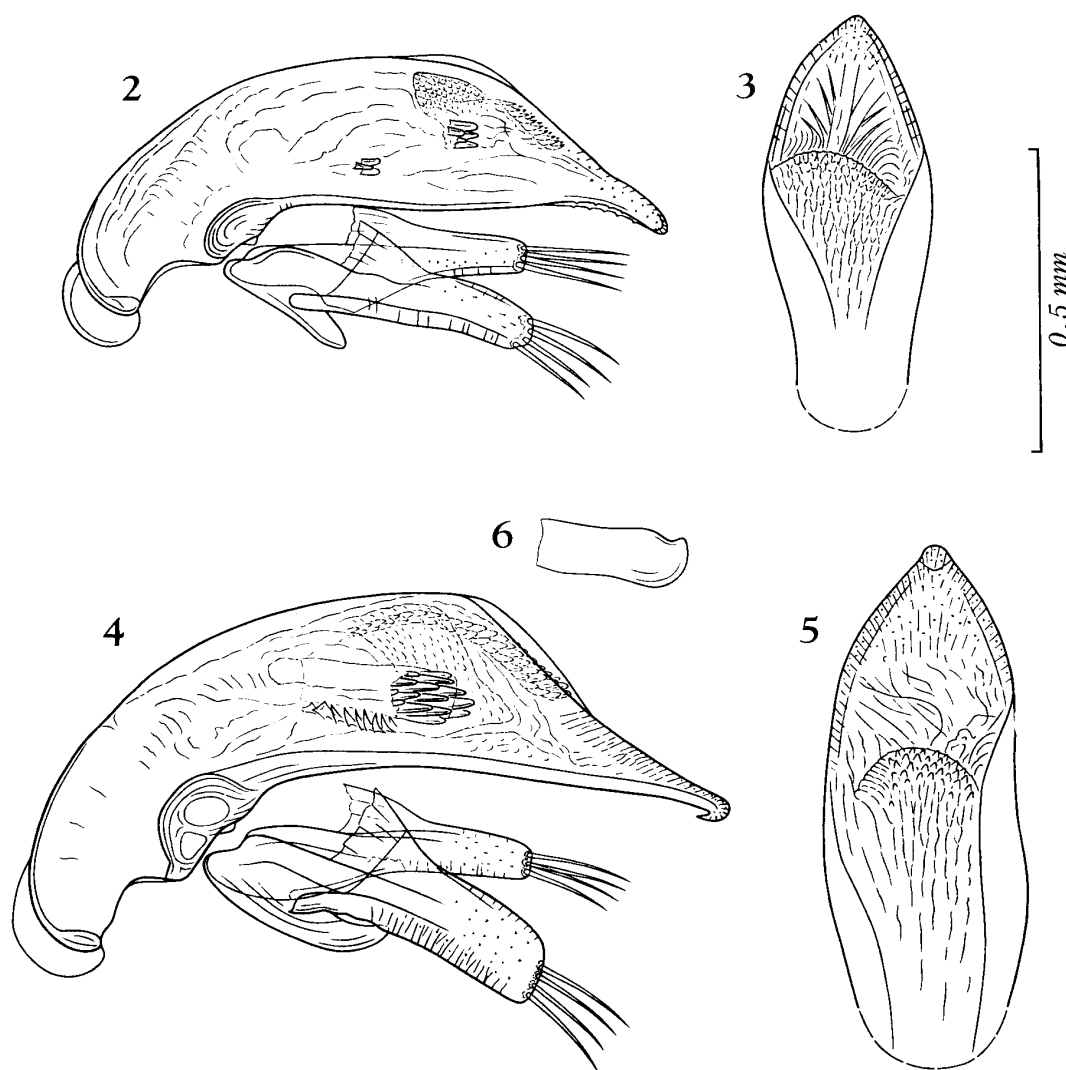
[Japanese name: Asuwa-mekura-chibigomimushi]

(Figs. 4–6)

Length: 4.85–6.25 mm (from apical margin of clypeus to apices of elytra).

Externally very similar to *T. subparallelus*, only differing from the latter in the more reddish coloration, shorter and less parallel-sided elytra, and some other minor details. It is, however, markedly different from that species in the structure of male genitalia.

Colour reddish brown, shiny, translucent when alive; appendages except for proximal segments of antennae yellowish brown. Head as in *T. subparallelus*, but the antennae are somewhat longer, always reaching the middle of elytra in ♂; mandibles more or less sharply hooked at apices; mentum tooth usually bifid as in *T. subparallelus*, but sometimes only truncated at the tip. Pronotum perfectly similar to that of *T. subparallelus*, with the exception of front angles which are a little more produced; PW/HW 1.43–1.54 (M 1.49), PW/PL 1.11–1.23 (M 1.17), PW/PA 1.43–1.56 (M 1.47), PW/PB 1.19–1.26 (M 1.23), PB/PA 1.15–1.25 (M 1.19). Elytra oblong-ovate, shorter and less parallel-sided than those of *T. subparallelus*, widest at a level between basal three-eighths and four-ninths, and less contracted towards bases than towards apices, with less salient shoulders and more regularly arcuate sides; EW/PW 1.46–1.59 (M 1.55), EL/EW 1.55–1.63 (M 1.60); surface convex, less depressed on the disc than in *T. subparallelus*; shoulders rounded, with prehumeral borders feebly arcuate and more oblique than in *T. subparallelus*; sides gently and regularly arcuate from shoulders to the level of the seventh pore of the marginal umbilicate series, without any emargination behind shoulders; apices conjointly rounded; striae shallower than in *T. subparallelus* and almost smooth, not so distinctly crenulate as in the latter species; apical striole joining usually stria 5, rarely stria 7; two dorsal pores on stria



Figs. 2-6. Male genitalia of *Trechiana* (s. str.) spp.; left lateral view (2, 4), apical part of aedeagus, dorsal view (3, 5), and separated copulatory piece, left lateral view (6). — 2-3. *T. subparallelus* S. UÉNO, sp. nov., from Awazu-onsen. — 4-6. *T. sasajii* S. UÉNO, sp. nov., from Nanatsuoguchi-kô Mine.

3 situated at $1/9-1/7$ (usually $1/8$) and $2/7-2/5$ (usually $1/3$) from base respectively, those on stria 5 at $1/15-1/9$ (usually $1/11$) and $1/2-3/5$ (usually $5/9$) from base respectively. Legs as those in *T. subparallelus*.

Male genital organ basically similar to that of *T. subparallelus* but considerably different from the latter in details. Aedeagus small, about three-tenths as long as elytra, short, thick, and slightly arcuate at middle, with small basal part feebly curved ventrad; basal orifice with deeply emarginate sides; sagittal aileron fairly large but hyaline; apical lobe flat, narrowly produced in lateral view, widely subtriangular in dorsal view, and with a sharp ventral hook at the extremity; viewed laterally, ventral margin slightly emarginate at middle but almost straight before apex. Inner sac armed

with a copulatory piece and three patches of sclerotized teeth or scales; copulatory piece elongate, lying at the middle of aedeagus, thin and hyaline except for moderately sclerotized apical portion, which is rounded and dorsally twisted; of the three teeth-patches, the right apical one consists of small scales, longitudinally extending on the dorsal side of inner sac and dilated at the apical part; the other teeth-patches lie at the left side of copulatory piece and narrowly connected with each other, the apical one consisting of large, heavily sclerotized teeth, while the proximal one is composed of a row of smaller teeth. Styles large and broad, left style with unusually broad apical part, each bearing four short setae at apex.

Type-series. Holotype: ♂, allotype: ♀, 24-IV-1977, Y. NISHIKAWA leg. (NSMT). Paratypes: 2 ♂♂, 1 ♀, 14-XI-1976, K. KATSURA & O. TOMINAGA leg. (NSMT); 11 ♂♂, 3 ♀♀, 24-IV-1977, S. UÉNO & Y. NISHIKAWA leg. (NSMT); 1 ♂, 10-VI-1977, H. SASAJI leg., found in a baited trap set by S. UÉNO and Y. NISHIKAWA on 24-IV-1977 (NSMT).

Type-locality. Tuff mine called Nanatsuoguchi-kô, at Asuwa of Fukui City, on the Japan Sea side of the Chûbu District, Central Japan.

Notes. Though closely related to the preceding, *T. sasajii* is more advanced than that species in the structure of male genitalia: a copulatory piece has already become differentiated, and the teeth-patches have undergone a moderate development. The aedeagal apical lobe is similarly shaped to that of *T. subparallelus*, but has a peculiar ventral hook at the extremity. On the other hand, the aedeagal structure of *T. sasajii* suggests the process of development of teeth-patches in the group of *T. ohshimai*; the three teeth-patches possessed by the species are no doubt homologous with the three isolated groups of teeth in *T. subparallelus*, and the narrowly connected left-hand teeth-patches in the former can be regarded as a step towards the formation of the large left proximal teeth-patch seen in more derivative species.

It may be worth noting that one of the paratypes of *T. sasajii* is completely lacking in the posterior dorsal pores, hence bearing only a single setiferous dorsal pore on each of the third and fifth striae on both the elytra. The occurrence of this striking aberrancy proves that the number of setiferous dorsal pores is not an absolutely reliable character even in the group of *T. ohshimai*, which can be regarded as very stable in chaetotaxial characteristics. If a female of such an aberrant specimen were singly brought forth, it might be wrongly considered to be a species belonging to other species-group than that of *T. ohshimai*.

This new species has been known only from an adit of a tuff mine dug into a small isolated hill lying at the southwestern part of Fukui City. The hill, called Asuwa-yama, is about 37 km distant to the southwest from the type-locality of *T. subparallelus*, and only attains to a height of 116 m even at the highest point. The adit that harbours *T. sasajii* is called Nanatsuoguchi-kô, lying under the central part of the hill about 20 m above sea-level. According to TSUKANO *et al.* (1965), who carefully explored and described the adit for the purpose of examining gravity anomalies, Nanatsuoguchi-kô measures about 440 m in its total length including five side

passages. *Trechiana sasajii* is found wherever the environmental condition is favourable, even near the entrance, usually from beneath rotten logs and boards abandoned in damp corners.

***Trechiana* (s. str.) *grandicollis* S. UÉNO, sp. nov.²⁾**

[Japanese name: Nukumi-mekura-chibigomimushi]

(Figs. 7, 70–72)

Length: 5.10–5.35 mm (from apical margin of clypeus to apices of elytra).

Relatively small species of subparallel habitus, readily recognized on very large fore-body and oblong elytra. Colour reddish brown, shiny, faintly iridescent on elytra; palpi, apical segments of antennae, epipleura and legs yellowish brown.

Head large, transverse and depressed above, with frontal furrows deep throughout and rather widely divergent in front and behind; frons and supraorbital areas gently convex; genae rather strongly convex though almost straightly convergent behind towards sharply marked neck constriction; neck wide; labrum shallowly emarginate at apex; mandibles stout, sharply hooked at apices; mentum tooth stout, with bifid tip; antennae fairly stout, reaching or almost reaching the middle of elytra, with segment 2 about two-thirds as long as segment 3 or 4, segments 8–10 each about three times as long as wide, terminal segment about as long as segment 3 and obviously longer but narrower than scape.

Pronotum large, transverse subcordate, much wider than head, evidently wider than long, widest at about five-eighths from base, and a little more strongly contracted towards apex than towards base; PW/HW 1.41–1.43 (M 1.42), PW/PL 1.17–1.21 (M 1.18), PW/PA 1.42–1.49 (M 1.46), PW/PB 1.30–1.35 (M 1.33); surface convex, covered with moderately impressed microsculpture; sides rather strongly arcuate in front, distinctly sinuate at basal one-fifth or a little before that level, and then either subparallel or very slightly divergent towards hind angles, which are somewhat sharp and gently produced posteriad; apex either straight or very slightly emarginate, with front angles obtuse and hardly produced; base more or less emarginate, wider than apex, PB/PA 1.09–1.11 (M 1.10); basal transverse impression rather deep, though largely included in large basal foveae.

Elytra oblong-ovate, widest at about middle though almost parallel-sided, and more or less depressed on the disc; EW/PW 1.42–1.48 (M 1.45), EL/EW 1.58–1.64 (M 1.62); microsculpture largely perceptible though not sharply impressed; shoulders distinct, with prehumeral borders feebly arcuate and not so oblique; sides either straight or very slightly emarginate behind shoulders, weakly but widely arcuate at middle, and moderately rounded to apices from behind the level of the seventh pore of the marginal umbilicate series; preapical emargination slight; each apex obtusely subangulate, forming a small re-entrant angle at suture; striae shallow, evenly impressed and lightly crenulate; scutellar striole fairly long, apical one deeply impressed,

2) Refer also to the postscript on pages 270 to 272.

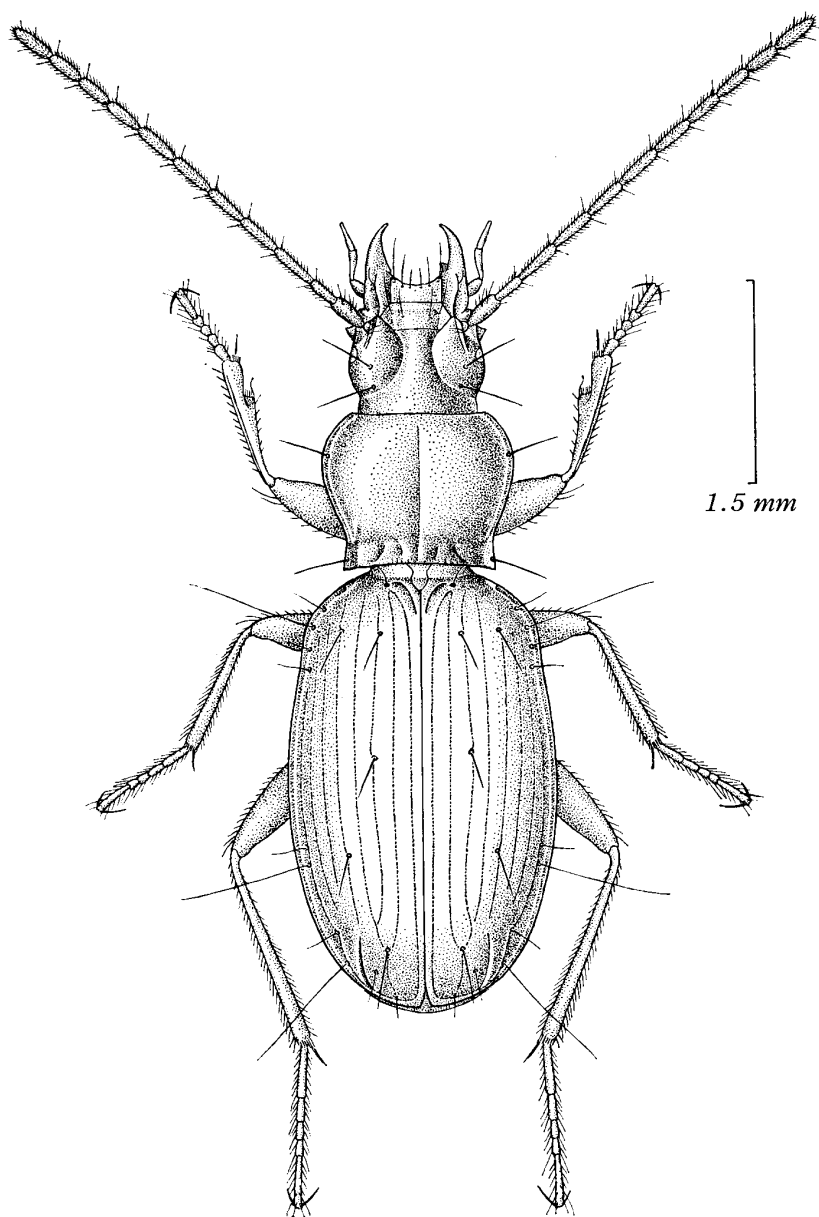


Fig. 7. *Trechiana* (s. str.) *grandicollis* S. UÉNO, sp. nov., ♀, from Nukumi.

almost straight in front and joining stria 5; two setiferous dorsal pores on stria 3 situated at $1/9-1/8$ and $1/3-2/5$ from base respectively, those on stria 5 at $1/12-1/9$ and $5/9-2/3$ from base respectively.

Legs relatively short and stout.

Male unknown.

Type-series. Holotype: ♀, paratypes: 4 ♀♀, 7-VII-1980, S. UÉNO, M. SATÔ & Y. HORI leg. (NSMT).

Type-locality. Nukumi, 680 m alt., 4.5 km NW of Mt. Nôgôhaku-san, in Ohno-shi of Fukui Prefecture, Central Japan.

Notes. Though tentatively placed next to *T. sasajii*, this distinctive new species may have a closer relationship to *T. tsurugaensis* to be described on later pages. It is relatively small in size, nearly equivalent to the largest specimens of the latter species, and its prothorax is evidently subcordate as in the latter and quite dissimilar to the characteristically subquadrate prothorax of the former. On the other hand, *T. grandicollis* has peculiarly subparallel facies, largely due to the large fore-body and the oblong elytra, the latter of which remind us of those of *T. subparallelus*. At present, I cannot decide the true affinity of *T. grandicollis*, which will remain undetermined until its aedeagal characters are examined.

This interesting trechine was discovered in a shaded gully on the right side of the upper stream of the Nukumi-gawa, a tributary of the Kuzuryû-gawa River that empties into the Sea of Japan. The gully lies at the south-southeastern foot of Kuranomata-yama, and is about 4.5 km distant to the northwest from Mt. Nôgôhaku-san, about 40 km to the east-northeast from the type-locality of *T. tsurugaensis*, and about 38.5 km to the southeast from that of *T. sasajii*. All the known specimens were found in a talus deposited under a small cascade, always from beneath large stones deeply buried in the talus.

***Trechiana* (s. str.) *nagahinis* S. UÉNO, 1976**

[Japanese name: Minoo-mekura-chibigomimushi]

(Figs. 9–10)

Trechiana (s. str.) *nagahinis* S. UÉNO, 1976, J. speleol. Soc. Japan, 1, p. 2, figs. 1–3; type-locality: Mine adit at Kabaya-dani on the Minoo Hills.

Length: 4.65–5.80 mm (from apical margin of clypeus to apices of elytra).

Small to medium-sized species readily recognized on the following combination of morphological features: head relatively large, with gently convex genae and long antennae, the latter of which reach apical third of elytra in ♂, apical three-eighths of elytra in ♀. Pronotum cordate, evidently wider than head, a little wider than long, widest at about two-thirds from base, and strongly contracted basad, with relatively narrow base which is about as wide as apex; sides strongly arcuate in front, deeply sinuate at about two-ninths from base, and then more or less divergent again towards sharp hind angles, which are produced postero-laterad. Elytra ovate, much wider than pronotum and relatively short; shoulders effaced, with oblique prehumeral borders; striae fairly deep, especially on the disc, scutellar striole short, apical striole short but deep. Legs fairly long and slender.

Male genital organ very small. Aedeagus only two-sevenths as long as elytra, short and broad, with the dorsal margin semicircularly rounded in profile; basal part elongate, moderately curved ventrad and provided with a small sagittal aileron; apical lobe flattened, subtriangular and broad in dorsal view, more or less curved ventrad and slightly turned up at the extremity in lateral view; no differentiated copulatory piece; left proximal teeth-patch elongate, right apical one small; styles short

and broad, each bearing four short setae at apex.

Type depository. Department of Zoology, National Science Museum (Nat. Hist.), Tokyo.

Additional specimens examined. 1 ♂, 1 ♀ (teneral), Masa-no-chaya (Adit T-1), Minoo Hills, Osaka Pref., 23-V-1977, Y. NISHIKAWA leg. (NSMT); 1 ♂ (teneral), same locality, 4-VI-1977, Y. NISHIKAWA leg. (NSMT); 3 ♂♂, 5 ♀♀, same locality, 21-VII-1977, Y. NISHIKAWA leg. (NSMT); 8 ♂♂, same locality, 6-XI-1977, S. UÉNO leg. (NSMT); 1 ♂, 3 ♀♀ (all teneral), Masa-no-chaya (Adit T-2), Minoo Hills, Osaka Pref., 23-V-1977, Y. NISHIKAWA leg. (NSMT); 1 ♂ (teneral), same locality, 21-VII-1977, Y. NISHIKAWA leg. (NSMT); 1 ♂, same locality, 6-XI-1977, S. UÉNO leg. (NSMT).

Range. Known so far only from the Minoo Hills to the north of Osaka, Central Japan.

Notes. The four species, *T. nagahinis*, *T. parvus*, *T. tsurugaensis* and *T. tenuiformis*, and probably also *T. grandicollis*, seem to form a species-complex within the group of *T. ohshimai*, though they can be discriminated at first sight from one another by the external characteristics alone. All the component species are relatively small in size and possess small or very small male genitalia, whose apical lobe is, though flattened, neither narrowly prolonged nor modified at the tip. *Trechiana nagahinis* is peculiar for the lack of differentiated copulatory piece.

The new localities of *T. nagahinis* recorded above are two adits dug into dacite tuff for prospecting damsite. They were located on the right side of a fork of the Minoo-gawa River, about 4.8 km north-northeast of the manganese mine at Kabayadani, the type-locality of the species, and about 2.2 km south of the collecting site of the first specimen (cf. UÉNO, 1976, pp. 6-7). One of them (Adit T-1) was dug in 1968, while the excavation of the other (Adit T-2) lasted from 1968 to 1974. The occurrence of *T. nagahinis* in the adits was made known nine years after their excavation, since NISHIKAWA first met with his specimens in the late spring of 1977. Though there is no way to determine since when the beetle has inhabited the adits, NISHIKAWA's data furnish an irrefutable proof that anophthalmic trechines are not confined in caves but normally live deep in the ground. Unfortunately, the adits were refilled in 1979 when the construction of the dam was completed, and the trechine became no longer obtainable.

Although *T. nagahinis* had been considered a very rare species, it was not so scarce in the lost adits, usually found from under logs or pieces of decayed boards. However, the beetle was never met with in the adits lying on the opposite side of the narrow river. These "sterile" adits were dug into granite, and this is probably why they did not harbour hypogean animals.

***Trechiamma* (s. str.) *parvus* S. UÉNO, sp. nov.**

[Japanese name: Ponpon-mekura-chibigomimushi]

(Figs. 8, 11–13)

Length: 4.20–4.75 mm (from apical margin of clypeus to apices of elytra).

Very small species of rather thickset body form, readily recognized on its cordate prothorax with nearly rectangular hind angles. Decisively different from *T. nagahinis* in the shape of male genitalia and above all, in the presence of a large copulatory piece.

Body relatively short and broad, with large fore-body and stout appendages. Colour reddish brown to dark reddish brown, shiny, ventral surface usually a little lighter than dorsum; palpi, apical segments of antennae, and legs yellowish brown.

Head subquadrate, about as wide as long, and depressed above, with frontal furrows evenly impressed throughout and moderately divergent in front and behind; frons and supraorbital areas gently convex; genae gently convex, especially at the posterior part; neck very wide; neck constriction rather shallow though distinct; labrum transverse, with the apical margin widely straight at the median portion; mandibles stout though sharply hooked at apices; mentum tooth narrow and porrect, always simple at the tip; antennae stout though fairly long, either reaching or extending slightly beyond the middle of elytra, with segment 2 about four-sevenths as long as segment 3, which is about as long as or slightly longer than segment 4, segments 8–10 each oblong-oval and nearly three times as long as wide, terminal segment about as long as segment 3, obviously longer, though narrower, than scape.

Pronotum cordate, much wider than head, a little wider than long, usually widest at about five-sevenths from base, and more strongly contracted towards base than towards apex; PW/HW 1.37–1.46 (M 1.42), PW/PL 1.09–1.19 (M 1.15), PW/PA 1.38–1.50 (M 1.43), PW/PB 1.37–1.46 (M 1.42); surface convex, with vague transverse striations; microsculpture largely perceptible though obliterated here and there; sides rather widely reflexed, strongly arcuate in front, less so behind, distinctly sinuate at a level between one-fifth and one-fourth (usually one-fourth) from base, and then usually subparallel towards hind angles (sometimes slightly convergent or divergent); apex either straight or slightly emarginate, about as wide as base, which is more or less emarginate, PB/PA 0.96–1.05 (M 1.01); front angles moderately produced, fairly wide and narrowly rounded at the tips; hind angles either rectangular or somewhat sharp, usually not produced laterad; basal transverse impression fairly deep, largely included in basal foveae which are large and deep.

Elytra oval and convex, widest at about middle or slightly before that level, and equally contracted towards bases and towards apices; EW/PW 1.50–1.68 (M 1.58), EL/EW 1.49–1.56 (M 1.53); microsculpture still perceptible though not sharply impressed; shoulders effaced, prehumeral borders straight and very oblique; sides rather widely reflexed at middle, moderately and regularly arcuate, with very slight preapical emargination; apices almost conjointly rounded, though forming a very small re-

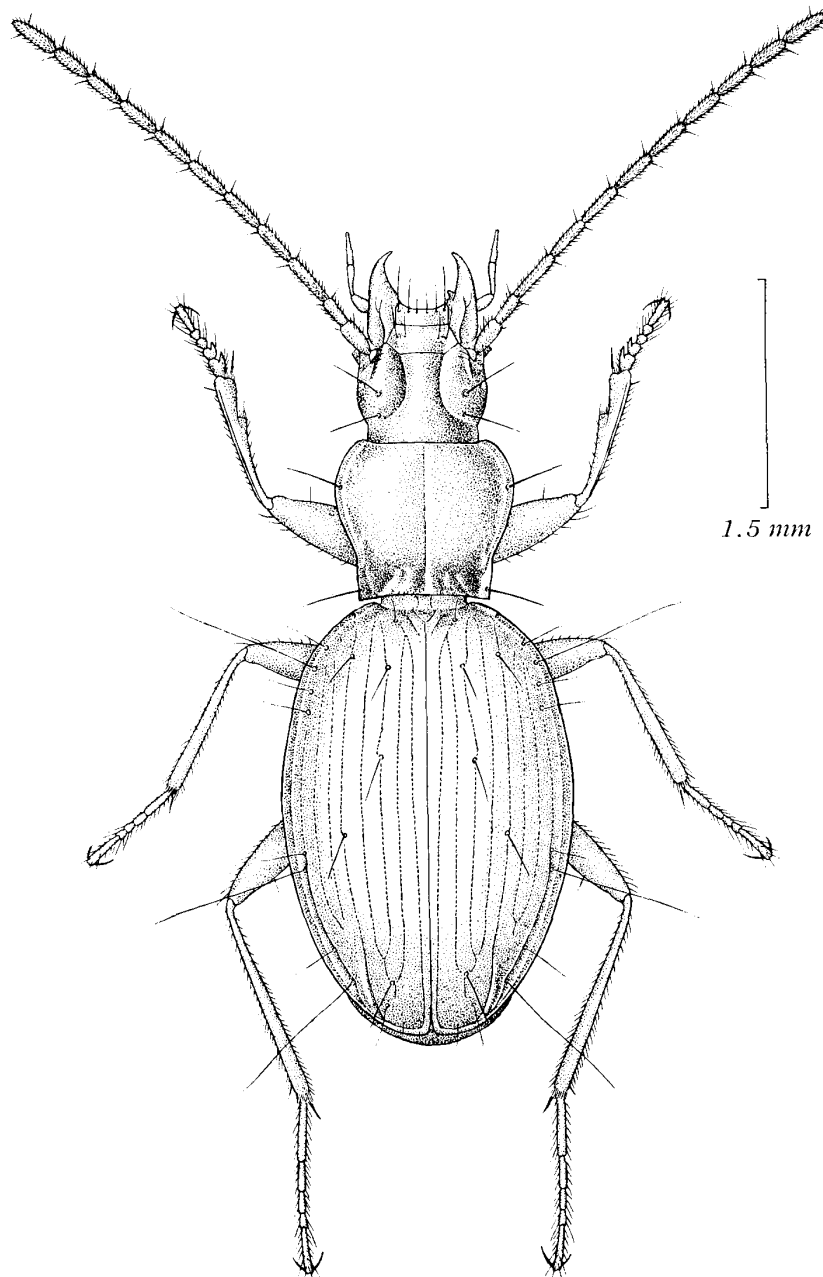


Fig. 8. *Trechiana* (s. str.) *parvus* S. UÉNO, sp. nov., ♂, from Izuriha.

entrant angle at suture; striae fairly deep, especially on the disc, and lightly crenulate; scutellar striole short but distinct; apical striole clearly impressed, hardly curved in front, and joining stria 5 (sometimes stria 7) without interruption; stria 3 with two setiferous dorsal pores at $1/8-1/7$ and $1/3-2/5$ from base respectively, stria 5 also with two setiferous dorsal pores at $1/9-1/7$ and $1/2-3/5$ from base respectively, the proximal pore being relatively distant from base.

Legs rather short and fairly stout.

Male genital organ generally similar to that of *T. nagahinis*, but the apical lobe is obviously shorter, and the inner sac bears a well differentiated copulatory piece and less developed left proximal teeth-patch. Aedeagus very small, about three-tenths as long as elytra, lightly sclerotized, weakly arcuate, and in lateral view, rather abruptly narrowed from behind the middle, with the apical lobe relatively short, flat and not curved ventrad; basal part narrow, moderately curved ventrad, and provided with a very small hyaline sagittal aileron; basal orifice with deeply emarginate sides; viewed laterally, apical lobe narrow and straight, with somewhat reflexed extremity; viewed dorsally, apical lobe broad, with obtusely subtriangular terminal portion; ventral margin widely, though shallowly, emarginate. Inner sac armed with a fairly large copulatory piece and two patches of teeth or scales; copulatory piece moderately sclerotized especially at the apical part, and twisted spatulate with the convex face towards the right wall, its apical margin being narrowly reflexed to the right and the ventro-apical corner produced into a narrow lobe; left proximal teeth-patch long and narrow, twisted at the middle, the proximal half consisting of a single row of large, heavily sclerotized teeth and the apical half of two or three irregular rows of smaller teeth; right apical teeth-patch much smaller than the left proximal and composed of rather poorly sclerotized scales. Styles fairly broad, left style being much larger than the right, each provided with four short setae at apex.

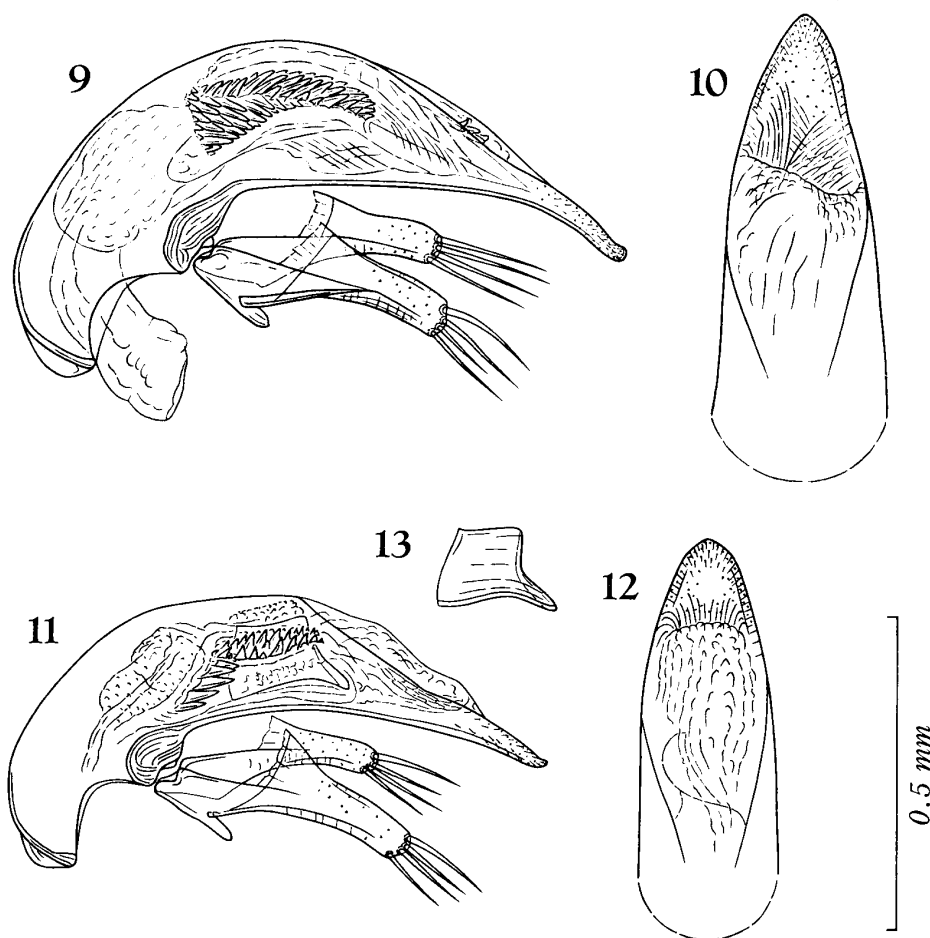
Type-series. Holotype: ♂, allotype: ♀, 20-IV-1980, S. UENO leg. (NSMT). Paratypes: 1 ♂, 20-V-1979, Y. NISHIKAWA leg. (NSMT); 1 ♂, 23-V-1979, Y. NISHIKAWA leg. (NSMT); 1 ♂ (teneral), 2-IX-1979, A. NOTO leg. (NSMT); 8 ♂♂, 4 ♀♀, 20-IV-1980, S. UENO leg. (NSMT); 3 ♂♂, 2 ♀♀, 24-V-1980, I. KOJIMA, K. MORI, A. NOTO, Y. TARUMI & S. WAKANO leg. (NSMT).

Type-locality. Izuriha, 350-370 m alt., at the WNW foot of Mt. Ponpon-yama, in Nishikyô-ku of Kyoto, Central Japan.

Further specimens examined. 1 ♂, 1 ♀, Tsuzuraori, 230 m alt., Higashibetsuin-chô, Kameoka-shi, Kyoto Pref., 4-VII-1980, Y. NISHIKAWA leg. (NSMT); 1 ♂, 2 ♀♀, Ryûsen-kyô, 130-160 m alt., Kurumatsukuri, Ibaraki-shi, Osaka Pref., 17-VI-1980, Y. NISHIKAWA leg. (NSMT).

Notes. This is the smallest known species of the group of *T. ohshimai* and is probably endemic to the southern part (excluding the southeastern edge) of the Nishiyama Hills on the right side of the Yodo-gawa River. In the present topography, these hills are not clearly separated from the Minoo Hills, and yet, the two hills are inhabited by remarkably different species of *Trechiana*, the former by *T. parvus* and the latter by *T. nagahinis*. It is difficult to elucidate at present what caused the speciation, but since the two species are not so closely related to each other, their differentiation may have been achieved in rather an old period.

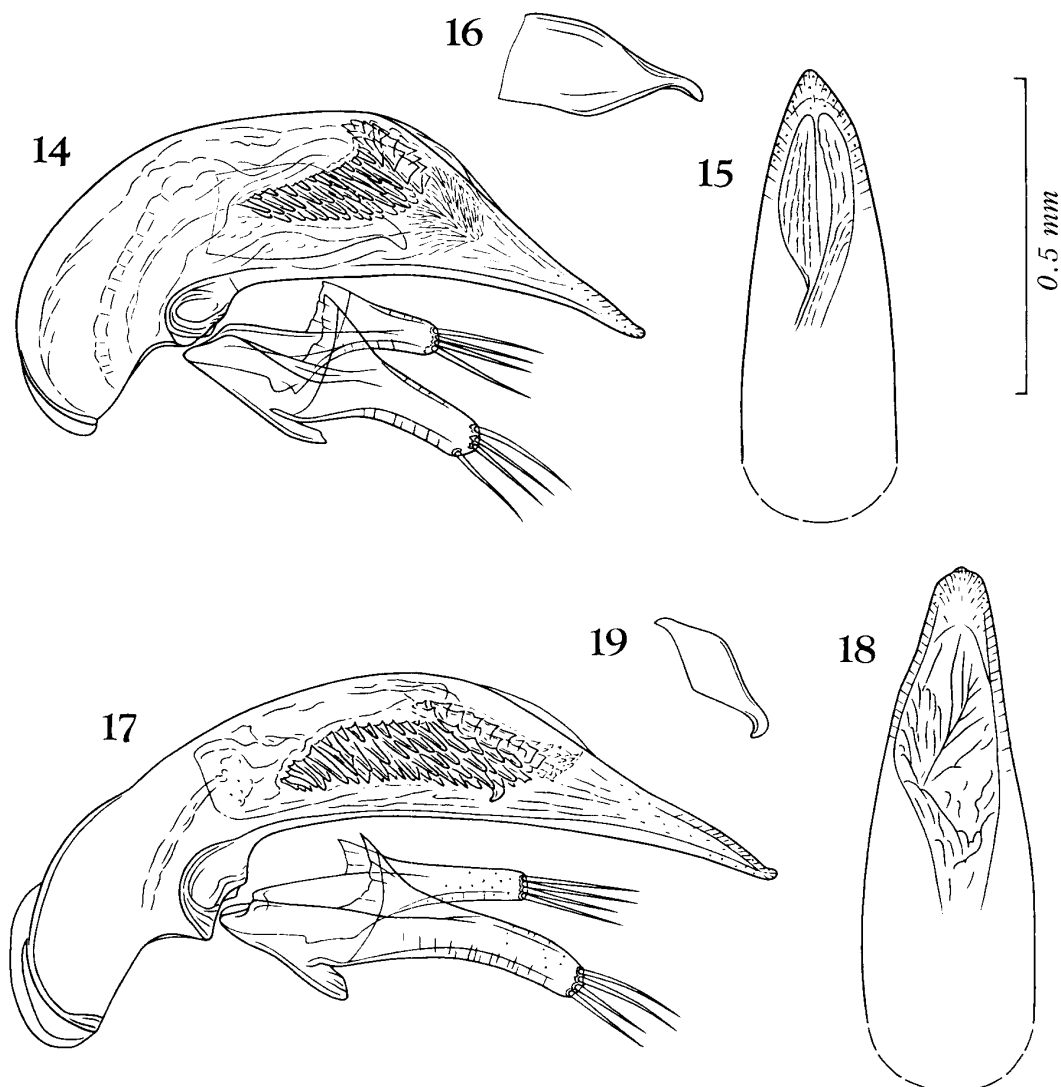
The type population of this new species occurs along a narrow stream flowing down the northwestern slope of Mt. Ponpon-yama (679 m in height), which is the highest point of the southern part of the Nishiyama Hills. Several isolated individuals were first met with from under stones lying at the edges of the stream running through



Figs. 9–13. Male genitalia of *Trechiana* (s. str.) spp.; left lateral view (9, 11), apical part of aedeagus, dorsal view (10, 12), and separated copulatory piece, left lateral view (13). — 9–10. *T. nagahinis* S. UÉNO, from a mine adit at Kabaya-dani of the Minoo Hills. — 11–13. *T. parvus* S. UÉNO, sp. nov., from Izuriha.

thickets of deciduous broadleaved trees and bamboos, while the majority of the known specimens were obtained from a talus of black slate deposited along a seepage on the right side of the stream. They were usually found at the muddy bottom 30–50 cm deep from the surface of the talus. A pair of the specimens of a *Stygiotrechus* were also taken by Messrs. NOTO and TARUMI at the same spot.

The specimens from the Ai-gawa drainage (Tsuzuraori and Ryûsen-kyô) are different from the type-series in minor details of male genitalia: the aedeagal apical lobe is a little longer and gently curved ventrad, and the left proximal teeth-patch is less developed, with a membraneous portion between the apical and ventro-proximal parts. However, the peculiarity is not so pronounced and cannot be regarded even as subspecific. The standard ratios are as follows: PW/HW 1.44–1.45 in the Tsuzuraori specimens, 1.35–1.42 in the Ryûsen-kyô ones; PW/PL 1.15 in the former, 1.15–1.18 in the latter; PW/PA 1.41–1.45 in the former, 1.41–1.47 in the latter; PW/PB



Figs. 14–19. Male genitalia of *Trechiana* (s. str.) spp.; left lateral view (14, 17), apical part of aedeagus, dorsal view (15, 18), and separated copulatory piece, left lateral view (16, 19). — 14–16. *T. tsurugaensis* S. UÉNO, sp. nov., from Kanegasaki-no-ana Cave. — 17–19. *T. tenuiformis* S. UÉNO, sp. nov., from Manbô-no-ana Cave/Mine.

1.43–1.45 in the former, 1.33–1.45 in the latter; PB/PA 0.97–1.01 in the former, 1.01–1.06 in the latter; EW/PW 1.51–1.60 in the former, 1.55–1.59 in the latter; EL/EW 1.51–1.54 in the former, 1.50–1.54 in the latter.

The Tsuzuraori specimens were taken in a gully on the left side of the Ai-gawa River, about 4.3 km west-southwest of the type-locality of *T. parvus* and about 12.8 km northeast of that of *T. nagahinis*. Of the three specimens from the Ryûsen-kyô, two females were taken at a spot on the left side of the Ai-gawa about 2 km south by west of the Tsuzuraori locality, while the single known male was obtained in a small gully on the right side about 900 m southwest of the spot at which the females were taken.

At all the collecting sites, the beetles were found from under stones lying at the edges of narrow streams.

***Trechiamma* (s. str.) *tsurugaensis* S. UÉNO, sp. nov.**

[Japanese name: Tsuruga-mekura-chibigomimushi]

(Figs. 14–16, 20)

Trechus (*Trechiamma*) *tsurugaensis* S. UÉNO, 1953, Shin Konchû, Tokyo, 6 (11), p. 44 [*nom. nud.*].

Length: 4.50–5.10 mm (from apical margin of clypeus to apices of elytra).

Distinguished at first sight from the two preceding species by the shape of pronotum and elytra, of which the former is transverse subcordate and has very wide base, while the latter are ovate, having the widest part much before the middle.

Body fairly elongate, with long slender appendages; fore-body relatively small. Colour light reddish brown, shiny, somewhat opalescent on elytra; palpi, scape and apical segments of antennae, ventral surface of hind body, and legs more or less yellowish brown.

Head subquadrate, somewhat wider than long, and depressed above; frontal furrows deeply impressed and rather widely divergent in front, becoming shallower and rather weakly curved posteriad to neck constriction, which is shallow and not sharply marked; frons and supraorbital areas gently convex; microsculpture finer than usual, largely consisting of very transverse meshes and lines; genae only slightly convex, rather flat at the posterior part; neck wide; labrum widely emarginate at apex, though the median portion of apical margin is straight; mandibles rather slender and sharply hooked; mentum tooth large and broad, either simple or bifid; antennae long and slender, reaching apical two-fifths to one-third of elytra, with segment 2 nearly two-thirds as long as segment 3 or 4, segments 8–10 each cylindrical and about 3.5 times as long as wide, terminal segment equal in length to segment 3 and about 1.5 times as long as scape.

Pronotum transverse subcordate, much wider than head, evidently wider than long, widest at about two-thirds from base, and a little more strongly contracted in front than behind; PW/HW 1.40–1.49 (M 1.46), PW/PL 1.15–1.22 (M 1.18), PW/PA 1.44–1.51 (M 1.47), PW/PB 1.21–1.30 (M 1.26); surface convex, with vague transverse striations; microsculpture more or less degenerated; sides widely and rather strongly arcuate in front, distinctly sinuate at a level between one-fifth and one-fourth from base, and then more or less divergent again towards hind angles, which are sharp and produced postero-laterad; apex slightly emarginate, with front angles obtuse, fairly wide and a little produced; base always slightly emarginate, much wider than apex, PB/PA 1.13–1.21 (M 1.16); basal transverse impression mal-defined, largely included in large basal foveae.

Elytra ovate and convex, widest at about two-fifths from base, and more pointed at apices than at bases, with ample basal area; EW/PW 1.49–1.59 (M 1.55), EL/EW 1.56–1.61 (M 1.59); microsculpture rather sharply impressed throughout; shoulders

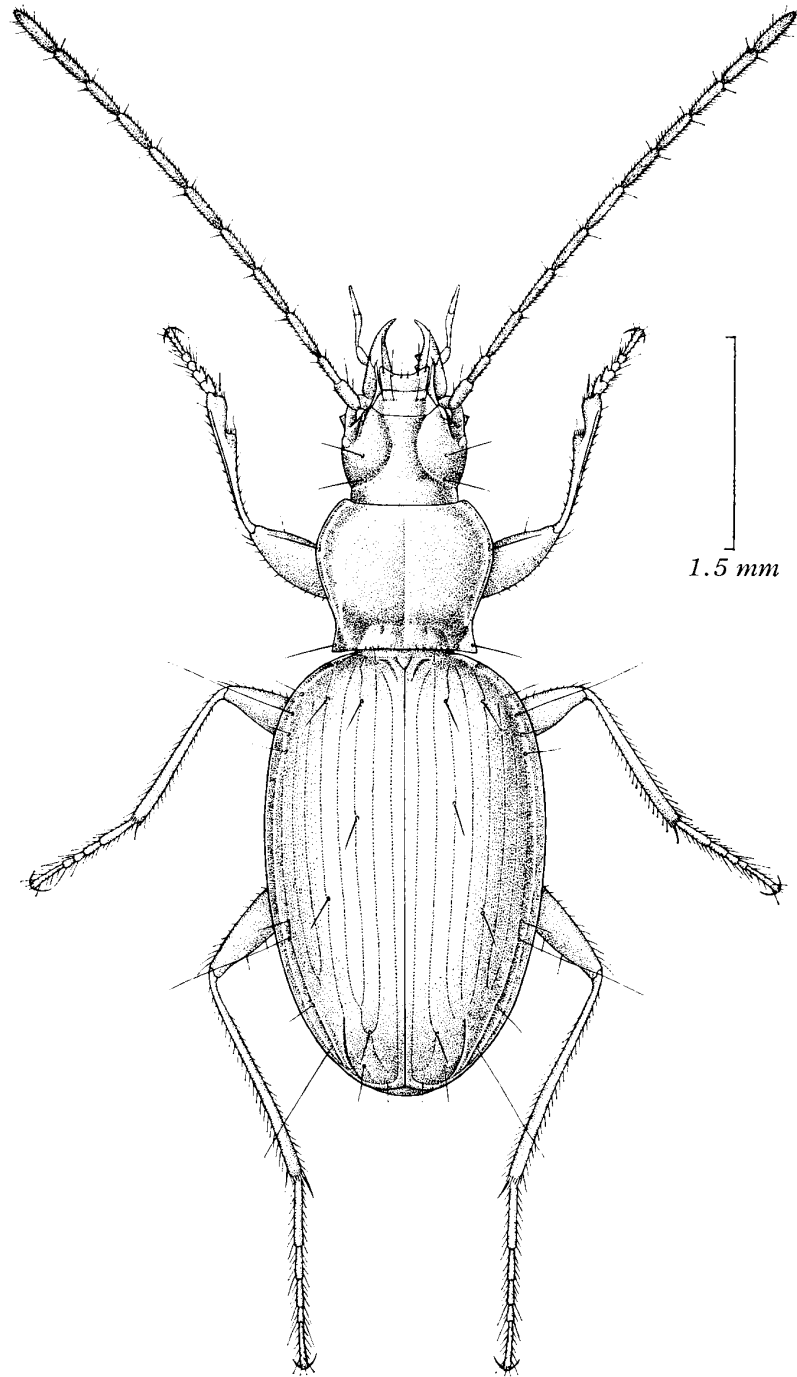


Fig. 20. *Trechiana* (s. str.) *tsurugaensis* S. UENO, sp. nov., ♂, from Kanegasaki-no-ana Cave.

widely rounded, with prehumeral borders oblique and feebly arcuate; sides rather widely reflexed before middle, feebly but regularly arcuate, preapical emargination very slight; apices subtruncated, forming a very obtuse re-entrant angle at suture; striae superficial, indistinctly crenulate, becoming shallower at the side though even

stria 7 is entire; scutellar striole short; apical striole deep, usually directed to stria 5, sometimes joining that stria without interruption, and rarely joining stria 7; two setiferous dorsal pores on stria 3 situated at $1/10-1/9$ and $3/10-3/8$ from base respectively, those on stria 5 at $1/12-1/10$ and $5/9-3/5$ from base respectively.

Legs long and slender; tarsi thin.

Male genital organ small and rather lightly sclerotized. Aedeagus one-third as long as elytra, short, robust, compressed, and in lateral view, rapidly attenuated from behind the middle, with large basal bulb and flattened apical lobe; viewed laterally, apical lobe narrow, slightly curved ventrad and ending in a blunt extremity; viewed dorsally, apical lobe gradually tapering towards apex and blunt at the extremity; ventral margin slightly but widely emarginate; basal part moderately curved ventrad and distinctly but not evenly emarginate at the sides of basal orifice; sagittal aileron very narrow, thin and hyaline. Inner sac armed with a differentiated copulatory piece and a large patch of heavily sclerotized teeth; the patch of large teeth lies on the left side at about middle of aedeagus and curved from ventro-proximal to dorso-apical; a group of poorly sclerotized teeth present just inside apical orifice behind the teeth-patch; copulatory piece large, lying at the right ventral side of the large teeth-patch, somewhat spatulate, with the apical part twisted, narrowly produced and curved ventrad. Styles short and broad, right style being much shorter than the left, each provided with four short setae at apex.

Type-series. Holotype: ♂, allotype: ♀, paratypes: 5 ♂♂, 4 ♀♀, 29-X-1952, S. UÉNO leg. (NSMT).

Type-locality. Limestone cave called Kanegasaki-no-ana, at Kanegasaki of Tsuruga-shi in Fukui Prefecture, on the Japan Sea side of Central Japan.

Notes. Though considerably differing in facies, this new species doubtless bears a close relationship with *T. parvus*, as is indicated by the similarity in the structure of male genitalia. Its type-locality is about 90 km distant to the north-northeast from that of the latter species, and the intervening area is occupied by several species belonging to another complex. Why and how such a discontinuous distribution has been formed is of deep interest, and will be taken up again under the heading of "Discussion" at the end of this paper.

This interesting species has been known only from a small limestone cave lying on the shore of the Bay of Tsuruga. The seawater seems to pour into the cave on stormy days, bringing in various organic matters. The trechine beetle was found from under decayed logs and boards or crawling on the muddy floor within several metres from the entrance.

***Trechiana* (s. str.) *tenuiformis* S. UÉNO, sp. nov.**

[Japanese name: Manbô-mekura-chibigomimushi]

(Figs. 17-19, 21)

Length: 4.85-5.55 mm (from apical margin of clypeus to apices of elytra).

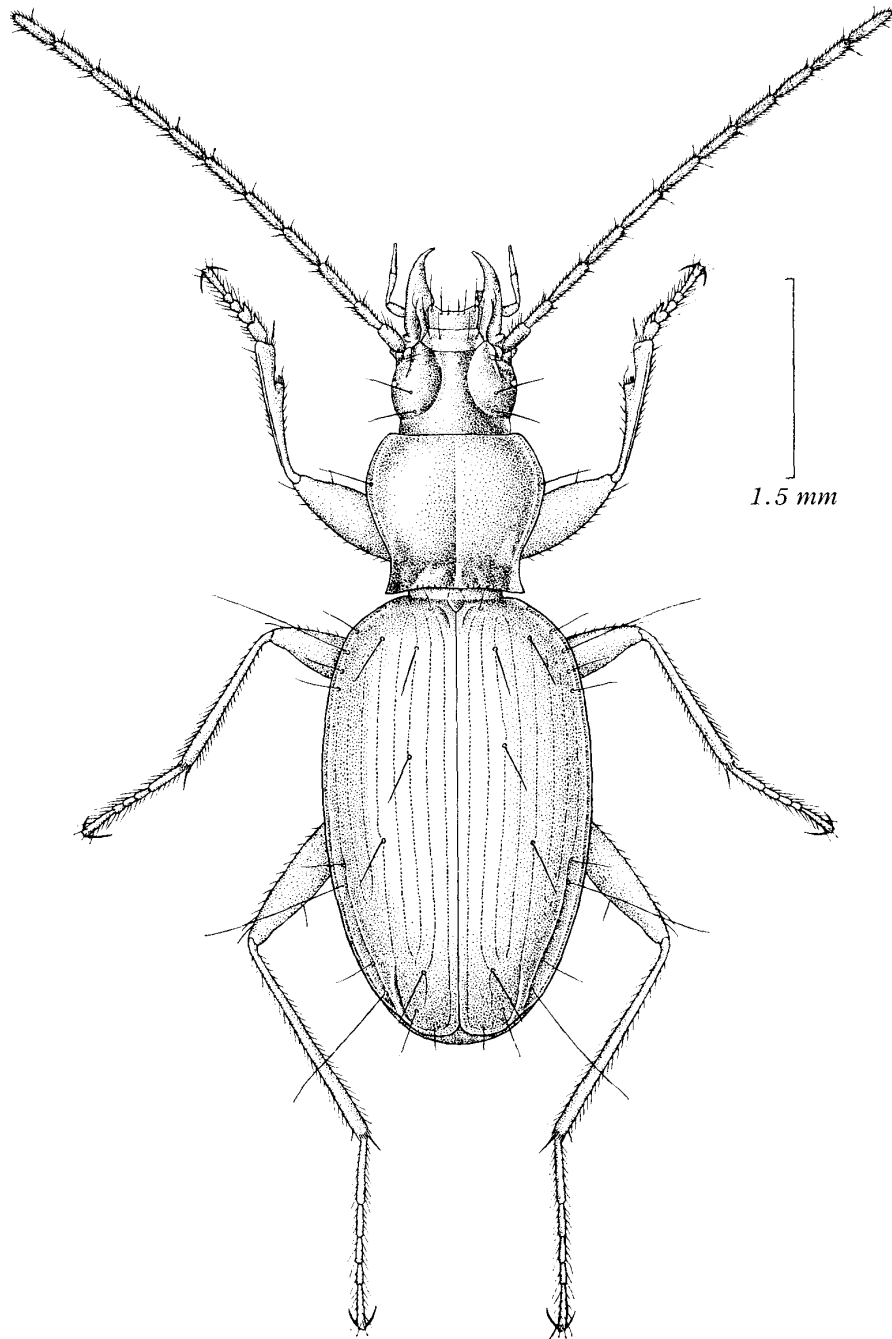


Fig. 21. *Trechiana* (s. str.) *tenuiformis* S. UENO, sp. nov., ♂, from Manbô-no-ana Cave/Mine.

Distinguished at first sight from all the known species of the group of *T. ohshimai* by the absence of postangular seta on pronotum; evidently allied to *T. tsurugaensis*, but the pronotum is larger and more strongly contracted behind, with more acute and outwardly protruding hind angles, the elytra are a little more elongate, the aedeagus is much slenderer with much more elongate apical lobe and basal part, the inner sac

bears two patches of heavily sclerotized teeth, of which the left proximal one is remarkably developed and sigmoidally curved, and the copulatory piece is much narrower, oblique and sharply hooked ventrad at the apex.

Body elongate and relatively parallel-sided, with long slender appendages; forebody relatively large. Colour as in *T. tsurugaensis*, though usually somewhat lighter.

Head as in *T. tsurugaensis*, but the genae are more evenly convex, the neck constriction is more distinctly marked, and the microsculpture is coarser and reticulated throughout; mentum tooth slightly bifid at the tip; antennae reaching apical three-sevenths of elytra or extending beyond that level. Pronotum cordate and convex, much wider than head, wider than long, widest at about two-thirds from base, and equally contracted in front and behind, though the base is obviously wider than apex due to the outward protrusion of hind angles; PW/HW 1.37–1.48 (M 1.43), PW/PL 1.09–1.21 (M 1.16), PW/PA 1.45–1.50 (M 1.48), PW/PB 1.24–1.33 (M 1.29), PB/PA 1.12–1.20 (M 1.15); sides regularly arcuate in front, distinctly and widely sinuate at a level between one-fifth and two-ninths from base, and then divergent again towards hind angles, which are acute, often denticulate, and protruding more laterad than posteriad; postangular seta absent; basal transverse impression usually deep and continuous, rugose at the bottom and laterally merging into basal foveae, which are large, deep and uneven; other pronotal features as in *T. tsurugaensis*. Elytra usually a little more elongate than those in *T. tsurugaensis*, usually widest at about three-sevenths from base, with the sides narrowly reflexed throughout and gently arcuate, but otherwise similar to the latter; EW/PW 1.48–1.58 (M 1.52), EL/EW 1.59–1.69 (M 1.63). Legs as in *T. tsurugaensis*.

Male genital organ relatively large, elongate and moderately sclerotized. Aedeagus tubular, about three-eighths as long as elytra, gently arcuate, with fairly long apical lobe and elongate basal part; dorsal margin regularly rounded at middle in profile; viewed laterally, apical lobe gradually attenuated towards blunt extremity, which is slightly turned up; viewed dorsally, apical lobe relatively narrow, gradually narrowed towards apex, which is obtusely subtriangular and indistinctly tuberculate at the tip; basal part moderately curved ventrad and deeply emarginate at the sides of large basal orifice; sagittal aileron large, though narrow and hyaline; ventral margin shallowly but widely emarginate in profile. Inner sac armed with a copulatory piece and two patches of heavily sclerotized teeth; copulatory piece lamellar, narrow and oblique parallelogram, with the ventro-apical corner narrowly produced and forming a ventrally curved hook; proximal teeth-patch very large, elongate, extending from left lateral to dorsal sides and sigmoidally curved on a horizontal plane; right apical teeth-patch small, semicircular, composed of small teeth, and adjacent to the apical end of proximal teeth-patch. Styles fairly elongate, left style obviously larger than the right, each usually with four short setae at apex, though one of them is sometimes lost on one style.

Type-series. Holotype: ♂, allotype: ♀, paratypes: 10 ♂♂, 1 ♀, 20–VII–1980, Y. NISHIKAWA leg. (NSMT).

Type-locality. Limestone cave/mine called Manbô-no-ana, at Shimokaidé of Makino-chô in Shiga Prefecture, Central Japan.

Notes. This new species belongs to the *nagahinis* complex and is obviously related to *T. tsurugaensis*, as is indicated by the similarity in external features. In the genitalic structure, however, it varies to some extent towards the *ohshimai* complex to be enumerated on the following pages; the aedeagal apical lobe is fairly long and relatively narrow, though still not comparable with the prolonged apical lobe in the species of the *ohshimai* complex, and the left proximal teeth-patch shows a remarkable development, forming a sigmoidally curved elongate patch as seen in many species of the latter complex. It has so far been known only from a limestone cave/mine lying in a small isolated hill, and this is probably why such a peculiar species in an intermediate stage of evolution can survive until today within the general range of the more advanced species-complex.

Manbô-no-ana, the type-locality of this remarkable species, is a limestone cave/mine located at the western foot (about 140 m above sea-level) of the low hill called Yamazaki-yama (444 m in height) on the northern coast of Lake Biwa-ko. It is about 21 km south by west of the type-locality of *T. tsurugaensis*, at the opposite side of the Nozaka Hills. Though adjacent to the eastern part of these hills, Yamazaki-yama is isolated by the wide valley of the Chinai-gawa, which runs round it. It is said that in former times, there was a small natural cave at the site of the limestone quarry, which was in operation in prewar days, but that it was destroyed by the lime manufactory. At present, it is difficult to tell whether the small cavities leading off from the bottom of the abandoned lime-pit are the remnants of natural caves or those of mine adits, but anyway, the trechine specimens were obtained in the twilight zone of one of them. They were found in a heap of muddy rock debris fed by trickling water, sometimes even from under dead leaves accumulated at the entrance.

It seems worth noting that one of the male paratypes of this new species has a well developed postangular seta at the ordinary position on the right side of its pronotum (but not on the left). This can be regarded as a reversion of pronotal chaetotaxy, indicating that the species has been derived from an ancestor that normally possessed the postangular seta like the other existing members of the species-group. Chaetotaxial reversion has been recorded on the elytra of several trechine beetles (*e.g.*, UÉNO, 1960, pp. 51, 53, 1973 b, pp. 188–189, 1977 b, p. 247), but so far as I am aware, has never been known until now on their prothoraces.

***Trechiana* (s. str.) *applanatus* S. UÉNO, sp. nov.**

[Japanese name: Natansho-mekura-chibigomimushi]

(Figs. 22–24)

Length: 5.40–5.95 mm (from apical margin of clypeus to apices of elytra).

Fairly large species of elongate body-form, decisively differing from the species described on the foregoing pages in the structure of male genitalia, above all in the

shape of aedeagal apical lobe which is remarkably prolonged. Colour reddish brown, shiny, translucent when alive, and faintly iridescent on elytra; appendages, especially apical segments of antennae, more or less lighter than body. Microsculpture almost evanescent on pronotum and elytra, though the vestige of fine transverse lines is still perceptible.

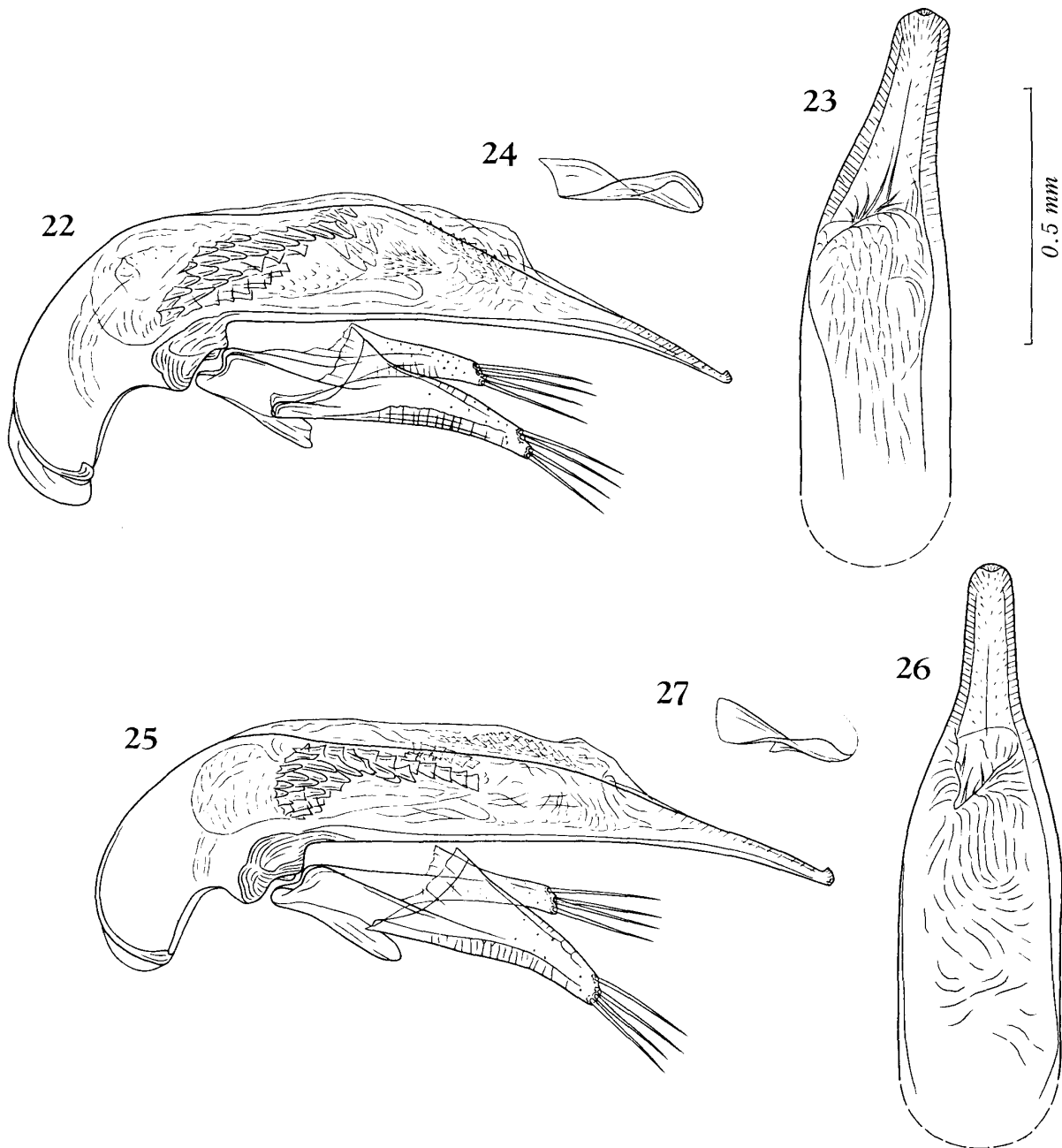
Head subquadrate, a little wider than long, and depressed above, with frontal furrows deeply impressed throughout and moderately divergent in front and behind; frons and supraorbital areas gently convex; genae evenly convex, not much contracted posteriad, neck constriction being shallow though distinct; neck very wide; labrum transverse, only shallowly emarginate at apex; mandibles fairly stout, feebly arcuate at the apical portions; mentum tooth broad, distinctly truncated and slightly bifid at the tip; antennae slender, reaching the middle of elytra, with segment 2 about two-thirds as long as segment 3 or 4, segments 8–10 each about three times as long as wide, terminal segment evidently longer than scape but narrower than the latter.

Pronotum subcordate and convex, much wider than head, a little wider than long, widest at five-eighths from base, and equally contracted in front and behind; PW/HW 1.40–1.45, PW/PL 1.12–1.16, PW/PA 1.47–1.52, PW/PB 1.26–1.30; sides rather strongly arcuate in front, distinctly sinuate at about one-fifth from base, and then gently divergent towards hind angles, which are sharp and produced laterad or postero-laterad; apex almost straight, with front angles narrowly rounded and hardly produced; base slightly bisinuate, distinctly wider than apex, PB/PA 1.17; basal transverse impression distinct, though largely included in basal foveae which are large and deep.

Elytra elongated convex and convex, though gently depressed on the disc, widest at about middle or a little before that level, and more pointed at apices than at bases; EW/PW 1.57–1.66, EL/EW 1.59–1.64; shoulders distinct though widely rounded, with prehumeral borders moderately oblique and slightly arcuate; sides narrowly bordered throughout, almost straight behind shoulders, then feebly arcuate to near apices, which are rather narrowly and separately rounded, forming a small re-entrant angle at suture; preapical emargination slight; striae superficial though evenly impressed, shallowly crenulate, scutellar striole long, apical striole long, deep and weakly curved, joining stria 5; two setiferous dorsal pores on stria 3 situated at about 1/10 and 3/10–3/8 from base respectively, those on stria 5 at 1/14–1/11 and about 5/9 from base respectively.

Legs fairly long though rather stout.

Male genital organ fairly large and heavily sclerotized. Aedeagus elongate, about three-eighths as long as elytra, hardly arcuate at middle and widely membranous on the dorsal surface, with remarkably prolonged apical lobe which is markedly flattened, weakly curved ventrad, inclined to the left and dorsally denticulate at the extreme tip; basal part curved ventrad, deeply emarginate on either side of basal orifice and provided with a fairly large but hyaline sagittal aileron; viewed laterally, apical lobe gradually attenuated and becoming very thin before apex; viewed dorsally, apical



Figs. 22–27. Male genitalia of *Trechiana* (s. str.) spp.; left lateral view (22, 25), apical part of aedeagus, dorsal view (23, 26), and separated copulatory piece, left lateral view (24, 27). — 22–24. *T. applanatus* S. UÉNO, sp. nov., from the Horikoshi-tôgé. — 25–27. *T. canalatus* S. UÉNO, sp. nov., from Shin-ohtani Mine.

lobe fairly broad to near apex, which is rounded; ventral margin almost straight or slightly emarginate at middle in profile. Inner sac armed with a fairly large copulatory piece and two elongate patches of large, heavily sclerotized teeth; copulatory piece lamellar and twisted, lying on the right side at about middle of aedeagus, with

rounded apex which bears an accessory lamella on the left side; of the two teeth-patches, the proximal one is much larger than the apical, obliquely extending from left ventral to left dorsal, then bent to the right and curved ventrad; the apical teeth-patch lies on the right dorsal side just inside apical orifice; a group of small, poorly sclerotized teeth present just behind the left proximal teeth-patch. Styles fairly slender, left style being longer than the right, each bearing four setae at apex.

Female unknown.

Type-series. Holotype: ♂, paratype: 1 ♂, 9-VI-1980, S. UÉNO & Y. NISHIKAWA leg. (NSMT).

Type-locality. Horikoshi-tôgé, 520 m alt., in Natashô-mura (also called Natan-shô-mura) of Fukui Prefecture, on the Japan Sea side of Central Japan.

Notes. This and the following eleven species can be regarded as forming a species-complex within the group of *T. ohshimai*, mainly characterized by the advanced structure of male genitalia: they are always large, the aedeagal apical lobe is remarkably prolonged with a modified tip, the lateral walls tend to reduce, and the teeth-patches attain a full development. *Trechiana applanatus* seems to be the most primitive component species hitherto known, since its aedeagus is still tubular though widely membranous on the dorsal surface, the apical lobe is only slightly reflexed or dorsally denticulate at the very tip, showing the least modification within the species-complex, and the left proximal teeth-patch is not sigmoidally curved. From this type, two different lines seem to have diverged; one (series of *T. angulicollis*) consists of the species in which the aedeagal lateral walls are complete and the apical lobe is dorso-ventrally thickened at the extremity, and the other (series of *T. ohshimai*) consists of those in which the aedeagal lateral walls become more or less reduced, forming a preapical convexity on either side, and the apical lobe is distinctly reflexed at the extremity.

The two known specimens of this interesting species were met with in a shaded gully about 320 m north by west of the Horikoshi-tôgé, a pass on the boundaries between Fukui and Kyoto Prefectures. The gully lies in a deciduous broadleaved forest at the upper end of the Horikoshi-dani Valley, one of the tributaries of the Minami-gawa River that empties into the Bay of Wakasa. The trechines were found at the edge of a very narrow stream, one on the soil beneath a large stone and the other on the surface of an upturned stone. A single specimen of another new trechine, belonging to the genus *Epaphiopsis*, was also taken at the same place.

***Trechiana* (s. str.) *canalatus* S. UÉNO, sp. nov.**

[Japanese name: Yugé-mekura-chibigomimushi]

(Figs. 25–27)

Length: 4.75–6.10 mm (from apical margin of clypeus to apices of elytra).

Very closely allied to *T. applanatus*, from which it cannot be distinguished with confidence by external morphology; in many individuals, the pronotum is more

strongly contracted towards narrower base and has more strongly arcuate sides, and the elytra are relatively short, with less salient shoulders, less ample basal area and more regularly arcuate sides, but none of these characteristics are definite. Constantly different from *T. applanatus* in certain details of aedeagal structure: aedeagus with reduced lateral walls, apical lobe narrower, copulatory piece much narrower, and left proximal teeth-patch sigmoidally curved.

Colour as in *T. applanatus*, with the exception of yellowish brown legs (more or less lighter than in the latter species). Head as in *T. applanatus*; mentum tooth usually simple, sometimes truncated at the tip or even bifid; antennae usually reaching the middle of elytra in ♂, a little shorter than that in ♀. Pronotum subcordate, widest at about five-eighths from base, and usually more strongly contracted basad than in *T. applanatus*; PW/HW 1.35–1.49 (M 1.44), PW/PL 1.10–1.17 (M 1.14), PW/PA 1.45–1.57 (M 1.52), PW/PB 1.28–1.37 (M 1.33); sides usually more strongly rounded in front than in *T. applanatus*, distinctly sinuate at a level between one-fifth and two-ninths from base, and then usually divergent again towards hind angles (sometimes subparallel or even slightly convergent); base relatively narrow, though always wider than apex, PB/PA 1.07–1.20 (M 1.14); hind angles sharp but not much produced. Elytra usually somewhat shorter than in *T. applanatus*, widest at about four-ninths from base, usually with less salient shoulders and narrower basal area; EW/PW 1.53–1.69 (M 1.60), EL/EW 1.50–1.64 (M 1.58); prehumeral borders more oblique; sides feebly but regularly arcuate in many individuals; apices more widely rounded or even subtruncated; two setiferous dorsal pores on stria 3 situated at 1/10–1/7 and 3/10–3/8 from base respectively, those on stria 5 at 1/12–1/9 and 1/2–5/8 from base respectively. Legs as in *T. applanatus*.

Male genital organ a little larger than that of *T. applanatus*. Aedeagus about three-sevenths as long as elytra, depressed, not arcuate at middle, and gradually narrowed from behind middle in profile, with the lateral walls distinctly reduced though having no preapical convexity at each side of apical orifice; basal bulb smaller and less strongly curved than in *T. applanatus*, with small hyaline sagittal aileron; apical lobe obviously narrower and a little shorter than in *T. applanatus*, parallel-sided in dorsal view, and dorsally denticulate at the extremity; copulatory piece much narrower than that of *T. applanatus*, twisted, apical margin becoming membranous and mal-defined; left proximal teeth-patch with the apical part sigmoidally curved on a horizontal plane; no small teeth-group on the left side behind the large teeth-patch.

Type-series. Holotype: ♂, allotype: ♀, Kawabata-kô, 28–VI–1980, Y. NISHIKAWA leg. (NSMT). Paratypes: 11 ♂♂, 8 ♀♀, Kawabata-kô, 28–VI–1980, Y. NISHIKAWA leg. (NSMT); 4 ♂♂, 4 ♀♀, Kawabata-shakô Daiichi-kô, 28–VI–1980, Y. NISHIKAWA leg. (NSMT).³⁾

Type-locality. Shin-oh-tani Mine (Kawabata-kô and Kawabata-shakô Daiichi-kô Adits), at Shimonaka of Keihoku-chô in Kyoto Prefecture, Central Japan.

Notes. This trechine is described as a full species with some reservation. Though

3) Of these 27 specimens of the paratypes, 11 (7 ♂♂, 4 ♀♀) are more or less teneral.

the majority of the known specimens can be discriminated from *T. applanatus* by small differences in the shape of prothorax and elytra, some individuals are externally so similar to the latter that the accurate recognition can be made only on the basis of genitalic features. Even these are basically similar to those of *T. applanatus* with the exception of the remarkable reduction of aedeagal lateral walls. However, as was mentioned in the "Notes" following the description of *T. applanatus*, the state of reduction of aedeagal lateral walls is a very important character in the classification of the species belonging to the *ohshimai* complex, dividing its component species into two evolutionary lines. By this reason, I consider it better to regard the Shin-ohtani Mine population as a species independent of *T. applanatus*.

The type-locality of *T. canalatus* is a manganese mine located in the heart of the Tanba Highlands about 19 km north-northwest of the City of Kyoto and about 20 km south-southeast of the type-locality of *T. applanatus*. Though about a dozen adits of the mine were dug into slate and bedded chert on the left side of a small branch of the Yugé-gawa, a tributary of the Ôi-gawa River, most of them are not accessible at present and only two have so far been known to be inhabited by the trechine beetle. One, called Kawabata-kô, was in operation from 1935 to 1944, and the other, called Kawabata-shakô Daiichi-kô, from 1972 to 1978. It is said that there was a connection between the two adits in former times, but that part is not passable now because of roof-collapse and submergence. Trechine specimens were taken from under stones and especially from under rotten mine posts; they were very active in Kawabata-kô Adit in which the air temperature was relatively high (18°C), but were rather sluggish in Kawabata-shakô Daiichi-kô, which was cool (10–12°C) as compared with the other.

***Trechiana* (s. str.) *angulicollis* JEANNEL, 1954**

[Japanese name: Kyôto-mekura-chibigomimushi]

(Figs. 28–30)

Trechiana angulicollis JEANNEL, 1954, Rev. fr. Ent., **21**, p. 12; type-locality: environs de Kioto.

Trechiana angusticollis JEANNEL, 1954, Rev. fr. Ent., **21**, pp. 12, 13; 1962, Rev. fr. Ent., **29**, p. 194, figs. 17–22 (syn. of *T. ohshimai*). [Err.]

Trechus (*Trechiana*) *Oreas*: JEANNEL, 1927, Abeille, Paris, **33**, p. 143, figs. 522–527 [nec H. W. BATES, 1883].

Length: 5.40–6.10 mm (from apical margin of clypeus to apices of elytra).

Externally very similar to *T. applanatus*, only differing from that species in the more cordate prothorax, somewhat narrower basal area of elytra, somewhat slenderer appendages, and a little more apparent microsculpture on pronotum and elytra. Strikingly different from *T. applanatus* in the structure of male genitalia; they are larger, the aedeagal apical lobe is narrower, less flattened, dilated at apex and dorso-ventrally thickened at the extremity, the copulatory piece is spatulate, not twisted lamellar, and the left proximal teeth-patch is sigmoidally curved.

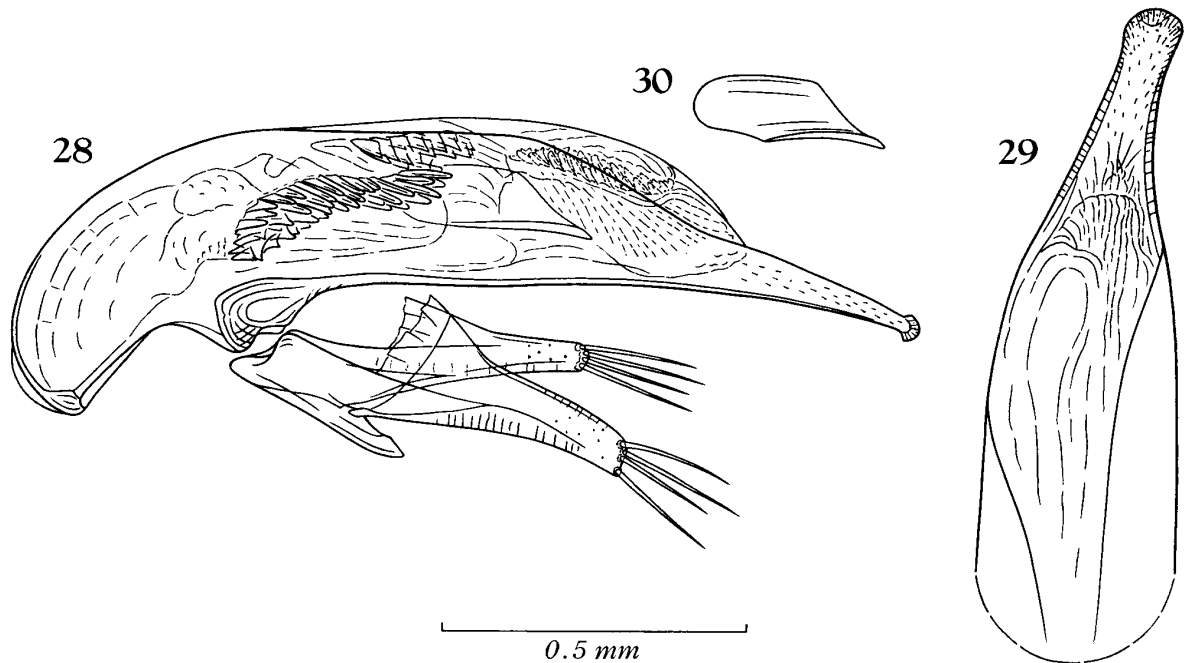
Head as in *T. applanatus*, but the neck constriction is somewhat deeper and the antennae are a little slenderer (usually extending slightly beyond the middle of elytra); mentum tooth usually truncated at the tip or slightly bifid, but sometimes simple. Pronotum more strongly contracted basad than in *T. applanatus* and usually with narrower base, though the width of base varies to some extent according to the shape of hind angles; PW/HW 1.40–1.52 (M 1.44), PW/PL 1.13–1.21 (M 1.17), PW/PA 1.44–1.53 (M 1.49), PW/PB 1.28–1.45 (M 1.37), PB/PA 1.05–1.16 (M 1.10); sides more strongly arcuate in front, more deeply sinuate at about one-fifth from base or a little behind that level, and then usually divergent towards hind angles, though rarely subparallel behind the ante-basal sinuation; hind angles usually large and sharp, protruding postero-laterad especially in ♂♂, sometimes less protruding though more or less sharp, and rarely rectangular even in ♂♂; base usually emarginate but rarely straight, always wider than apex, which is either straight or emarginate; front angles usually a little produced and narrowly rounded. Elytra as in *T. applanatus*, but the basal area is a little narrower, having more oblique prehumeral borders, and the sides are evenly arcuate from behind shoulders to near apices; EW/PW 1.46–1.67 (M 1.60), EL/EW 1.53–1.66 (M 1.59); two setiferous dorsal pores on stria 3 situated at 1/10–1/8 and 3/10–3/8 from base respectively, those on stria 5 at 1/11–1/9 and 1/2–5/8 from base respectively.

Legs slenderer than in *T. applanatus*.

Male genital organ large and heavily sclerotized, larger and more elongate than in *T. applanatus*. Aedeagus about three-sevenths as long as elytra, not arcuate at middle, and gradually attenuated towards apex; basal part large and weakly curved ventrad, with large basal orifice, the sides of which are deeply emarginate; sagittal aileron very narrow and hyaline, sometimes vestigial; viewed laterally, apical lobe very long and narrow, gradually tapering towards apex, either straight or slightly curved ventrad, and thickened at the extreme tip on both the dorsal and ventral sides; viewed dorsally, apical lobe narrowly prolonged, inclined to the left, and slightly dilated at apex; ventral margin almost straight at middle in profile. As in *T. applanatus*, the inner sac is armed with a fairly large copulatory piece and two elongate patches of large, heavily sclerotized teeth, but they are different in shape from those of the northern species; copulatory piece asymmetrically spatulate, with the left apical corner obtusely produced; left proximal teeth-patch curved sigmoidally, extending from left lateral to dorsal sides, turning inwards and then apicad. Styles as in *T. applanatus* though usually a little broader, each usually provided with four apical setae; a short additional seta sometimes present on one of the styles (rarely on both of them).

Type depository. Laboratoire d'Entomologie, Muséum National d'Histoire Naturelle, Paris.

Specimens examined. 1 ♂ (holotype), "Kioto, Japon" (MP); 1 ♂, Mt. Hiéi-zan, NE of Kyoto, 22–VII–1951, T. HORIO leg. (NSMT); 1 ♀, Kibuné, 300 m alt., N of Kyoto, 17–V–1953, H. ISHIDA leg. (NSMT); 1 ♀, same locality, 5–V–1956, H. ISHIDA leg. (NSMT); 1 ♂, same locality, 27–IV–1958, H. KONISHI leg. (TS); 2 ♀♀, same

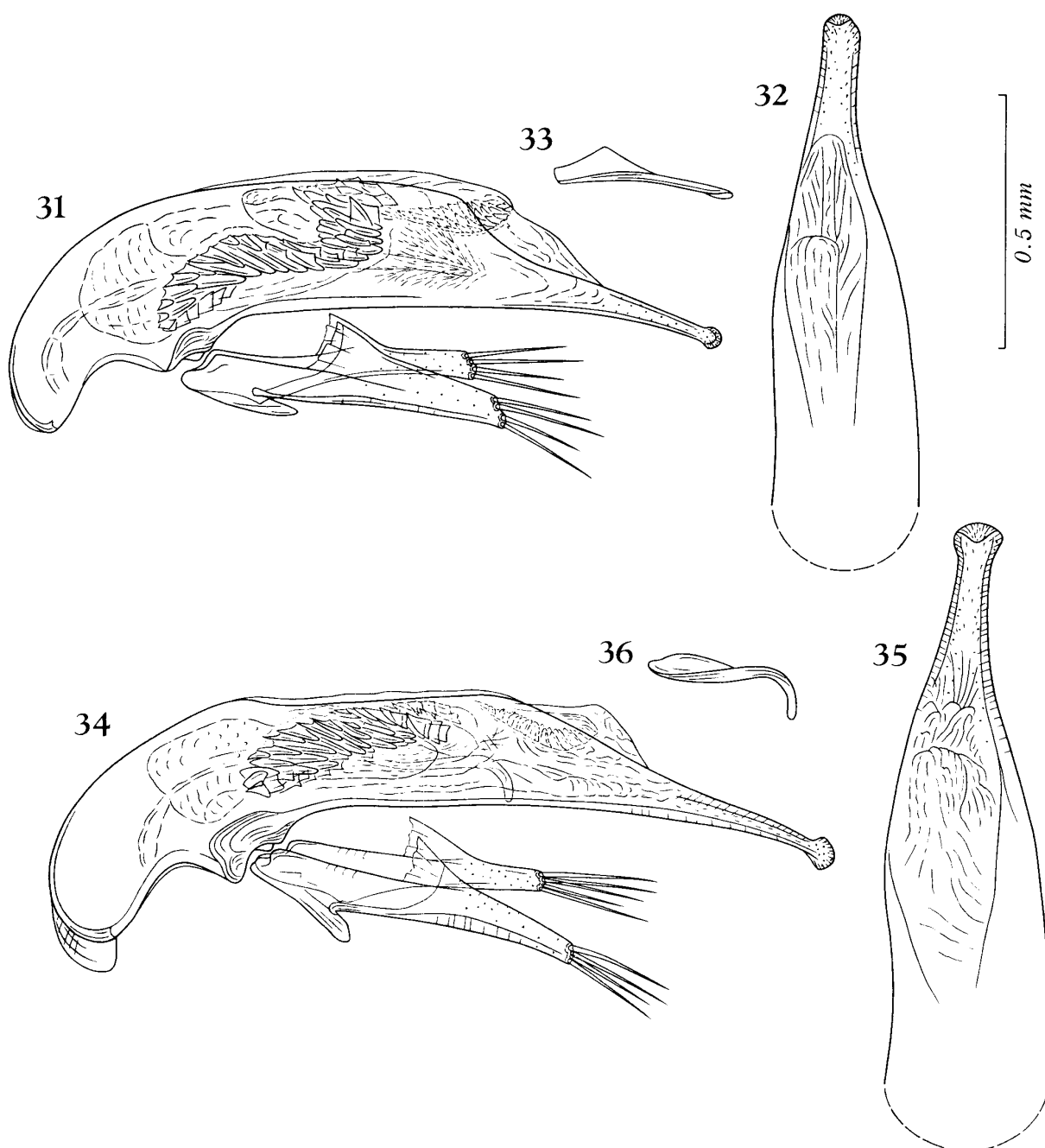


Figs. 28–30. Male genitalia of *Trechiama* (s. str.) *angulicollis* JEANNEL, from Kibuné; left lateral view (28), apical part of aedeagus, dorsal view (29), and separated copulatory piece, left lateral view (30).

locality, 29–IV–1958, T. SHIBATA leg. (NSMT & TS); 1 ♂, 4 ♀♀, same locality, 25–VI–1958, T. SHIBATA leg. (NSMT & TS); 1 ♂, Kurama-yama, N of Kyoto, 29–IV–1960, Y. HAMA leg. (NSMT); 9 ♂♂, 7 ♀♀ (incl. teneral 3 ♂♂, 1 ♀), Aso-dani, 450 m alt., Oku-Kibuné, N of Kyoto, 19–VII–1980, S. UÉNO & Y. NISHIKAWA leg. (NSMT); 3 ♂♂, 1 ♀, same locality, 6–VIII–1980, S. UÉNO leg. (NSMT); 1 ♂, 1 ♀, Oku-Kibuné, 450 m alt., N of Kyoto, 6–VIII–1980, S. UÉNO leg. (NSMT); 1 ♂, Seryô-tôgé (SE side), 620 m alt., N of Kyoto, 6–VIII–1980, A. SAKAI leg. (NSMT); 2 ♂♂, Hanasé-tôgé, 620 m alt., N of Kyoto, 10–V–1956, S. UÉNO leg. (NSMT); 1 ♂, Daihi-zan, N of Kyoto, 10–V–1964, Y. HAMA leg. (NSMT); 1 ♂, Kurihara, Shiga-chô, Shiga Pref., 1–VI–1974, H. IWASAKI leg. (NSMT).

Range. Northern and northeastern hills of Kyoto City in Central Japan. Its occurrence at Kurihara, a locality at the southern edge of the Hira Mountains, is unexpected, but *T. angulicollis* has never been found in coexistence with *T. brevior*, which occurs at higher places of the same mountains.

Notes. As was already explained in the introduction of the present paper, this is the type-species of the genus *Trechiama*. Its exact type-locality is not known, but can safely be surmised to be either the Kibuné-Kurama area or Mt. Hiéi-zan, considering that they are the only places in the vicinities of Kyoto frequently visited by prewar collectors. It is not plausible that the type-specimen should have been taken at one of the other localities recorded above, since those places were not readily accessible at the beginning of this century.



Figs. 31–36. Male genitalia of *Trechiana* (s. str.) spp.; left lateral view (31, 34), apical part of aedeagus, dorsal view (32, 35), and separated copulatory piece, left lateral view (33, 36).
 — 31–33. *T. rotundipennis* S. UÉNO, sp. nov., from Takatsuka-yama of the Daigo Hills.
 — 34–36. *T. mahoae* S. UÉNO, sp. nov., from the Karaiké-tôgé.

Of the eight localities now known to harbour *T. angulicollis*, Kibuné and Kurama-yama lie side by side at the north of Kyoto City, Oku-Kibuné (including the Aso-dani Valley) lies about a half way from Kibuné to the Seryô-tôgé, the latter of which is located about 2.2 km north by west of the former, the Hanasé-tôgé is about 4.5 km north by east of Kurama-yama, and Daihi-zan is about 8.5 km further north of the

Hanasé-tôgé. Mt. Hiéi-zan (848 m in height) towers at the northeast of Kyoto City and is about 8 km distant to the southeast from Kurama-yama. The remaining one, Kurihara, is about 10 km distant to the east from the Hanasé-tôgé and is at the southern edge of the Hira Mountains on the western side of Lake Biwa-ko.

Trechiana angulicollis is an endogean species usually met with in small taluses at the side of shaded narrow streams. The Hanasé-tôgé specimens were, however, collected from a talus deposited in a small depression in a cryptomeria plantation far from streams.

***Trechiana* (s. str.) *rotundipennis* S. UÉNO, sp. nov.**

[Japanese name: Daigo-mekura-chibigomimushi]

(Figs. 31–33)

Length: 5.20–5.90 mm (from apical margin of clypeus to apices of elytra).

Closely allied to *T. angulicollis*, but the prothorax is less transverse, the elytra are broader and shorter, having more rounded sides, the male genitalia are shorter, with shorter and narrower apical lobe, and the copulatory piece is sagittate with rod-like apical part.

Head as in *T. angulicollis*, though the genae are a little less convex and the neck constriction is less sharply marked; mentum tooth either simple or slightly truncated at the tip; antennae reaching apical three-sevenths of elytra. Pronotum less transverse than in *T. angulicollis*, though otherwise similar to that of the latter; PW/HW 1.35–1.46 (M 1.40), PW/PL 1.05–1.12 (M 1.08), PW/PA 1.40–1.49 (M 1.44), PW/PB 1.24–1.34 (M 1.29), PB/PA 1.08–1.13 (M 1.11); hind angles more or less sharp and produced postero-laterad. Elytra ovate and convex, broader and shorter than in *T. angulicollis*, widest at about four-ninths from base, and equally contracted in front and behind; EW/PW 1.65–1.79 (M 1.74), EL/EW 1.50–1.55 (M 1.53); shoulders less distinct, sometimes almost effaced, with prehumeral borders more oblique; sides rather widely reflexed at middle, moderately arcuate from shoulders to near apices, which are relatively pointed; striae as in *T. angulicollis*, but the apical stria is shorter and less arcuate, usually joining stria 7 instead of stria 5. Legs as in *T. angulicollis*.

Male genital organ generally similar to that of *T. angulicollis*, but obviously shorter and different from the latter in the following details: aedeagus three-eighths as long as elytra, rather abruptly narrowed from behind middle in profile, with shorter and narrower apical lobe whose tip is hardly dilated in dorsal view; sagittal aileron vestigial; copulatory piece narrow and sagittate, with the apical part very narrow, rod-like and almost straight; left proximal teeth-patch much larger, consisting of larger teeth.

Type-series. Holotype: ♂, 21–VI–1980, Y. NISHIKAWA leg. (NSMT). Allotype: ♀, 20–XI–1978, S. UÉNO leg. (NSMT). Paratypes: 1 ♂ (teneral), 26–VI–1978, S. OKAJIMA leg. (NSMT); 1 ♀, 5–XI–1978, Y. NISHIKAWA leg. (NSMT).

Type-locality. Takatsuka-yama, 130–270 m alt., of the Daigo Hills at the south-

east of Kyoto in Central Japan.

Notes. Although the external difference between this and the preceding species is by no means large, it is still more pronounced than that between *T. angulicollis* and *T. mahoae* or between *T. angulicollis* and *T. applanatus*. And yet, there is little reason to doubt the validity of the latter taxa, seeing that genitalic differentiation, and therefore reproductive isolation, seems complete between them. In the genitalic structure, *T. rotundipennis* is most closely related to *T. angulicollis*, but the conformation of aedeagal inner armature seems sufficiently different to ensure their specific independency.

It is most unexpected that the Daigo population of *Trechiana* has become differentiated to the species level. Though separated by the low pass called the Ohsaka-tôgê (165 m in altitude), the Daigo Hills can be regarded as the southern continuation of the Hiéi Mountains, which are the southeasternmost known locality of *T. angulicollis*. Since *T. rotundipennis* has been taken even at a spot only 130 m in altitude, the low elevation of this pass cannot have barred the dispersal of anophthalmic trechines. The gap that caused the speciation may not be topographical but geological: the Hiéi Mountains are largely formed by granite not favourable for the existence of endogean beetles.

Trechiana rotundipennis has been found along a stream flowing down the north-western slope of Takatsuka-yama, a low head (485 m in height) of the Daigo Hills lying about 11 km south of Mt. Hiéi-zan. It does not appear to be common, probably for the lack of favourable habitats. All the known specimens were taken, as isolated individuals, from under stones or dead leaves lying at the shaded edges of the stream.

It may be worth noting that in the allotype, there is an extra lateral seta in front of the ordinary one on the left side of the pronotum. Though chaetotaxial aberrancy is rather frequent on elytra, its occurrence on pronotum is very rarely met with in Trechinae.

***Trechiana* (s. str.) *mahoae* S. UÉNO, sp. nov.**

[Japanese name: Maho-mekura-chibigomimushi]

(Figs. 34–36)

Length: 5.90–6.10 mm (from apical margin of clypeus to apices of elytra).

Again very close to *T. angulicollis* and hardly distinguishable from the latter by external morphology, but it is unique in the conformation of copulatory piece, especially in the presence of a long arcuate apical projection.

Equivalent in size to the largest individuals of *T. angulicollis*. Head perfectly similar to that of *T. angulicollis*; antennae reaching apical three-sevenths of elytra. Pronotum relatively narrow but otherwise similar to that of *T. angulicollis*; PW/HW 1.42–1.46 (M 1.44), PW/PL 1.12–1.14 (M 1.13), PW/PA 1.42–1.48 (M 1.45), PW/PB 1.27–1.32 (M 1.30), PB/PA 1.10–1.14 (M 1.12). Elytra as in *T. angulicollis*, though relatively large and with more sharply crenulate striae; EW/PW 1.65–1.70 (M 1.68),

EL/EW 1.60–1.63 (M 1.61); two setiferous dorsal pores on stria 3 situated at about 1/7 and 3/8 from base respectively, those on stria 5 at 1/10–1/9 and about 4/7 from base respectively. Legs similar to those in *T. angulicollis*.

Male genital organ similar in general appearance to that of *T. angulicollis*, but all the components are slenderer than those of the latter. Aedeagus elongate and slender, about two-fifths as long as elytra, with the basal part relatively narrow and moderately curved ventrad; sagittal aileron not large but moderately developed; apical lobe longer and narrower than in *T. angulicollis*, with larger terminal dilatation. Copulatory piece rather heavily sclerotized, very narrow and somewhat spatulate, with the apical part thinly prolonged and arcuately curving down. Styles obviously narrower than those in *T. angulicollis* but of the same basic structure as the latter; in one of the paratypes, an extra seta exists on the right style.

Female unknown.

Type-series. Holotype: ♂, paratypes: 5 ♂♂, 18–V–1980, S. UÉNO and M. & K. KATO leg. (NSMT).

Type-locality. Karaiké-tôgé, 390 m alt., above Yubuné, on the northeastern ridge of Mt. Jubu-zan, in Watsuka-chô of Kyoto Prefecture, Central Japan.

Notes. Like *T. rotundipennis*, this new species has doubtless been derived from *T. angulicollis*. It is practically indistinguishable from the latter species by its external characters alone, but is strikingly different in the conformation of copulatory piece, which makes it closer to *T. rotundipennis*. Perhaps the ventro-apical corner of the copulatory piece became prolonged and rod-like, as seen in *T. rotundipennis*, at the first stage of differentiation, and then it underwent further modification to form the peculiarly arcuate apical process possessed by *T. mahoae*.

This interesting species has hitherto been found only at a spot on the eastern side of the Karaiké-tôgé, a pass on the northeastern ridge of Mt. Jubu-zan (685 m in height) of the Kôga Hills. The collecting site is about 16.5 km distant to the southeast from the type-locality of *T. rotundipennis*, beyond the deep valley of the Seta-gawa River which is the outlet of Lake Biwa-ko. The trechine lived in a muddy talus deposited under a cliff lying just between a cryptomeria plantation and a scrub of deciduous broadleaved trees. The talus was fed by a seepage from the cliff and wet throughout. The beetles were met with at the depth of 20–50 cm, almost always under stones buried in damp soil.

The present species was named after Maho, the daughter of Minoru and Kyôko KATO whose kind help in the field led to the discovery.

Trechiana (s. str.) *brevior* S. UÉNO, sp. nov.

[Japanese name: Kohoku-mekura-chibigomimushi]

(Figs. 37–39)

Length: 4.85–5.70 mm (from apical margin of clypeus to apices of elytra).

Externally similar to *T. applanatus*, but the prothorax is usually a little more

transverse and more strongly contracted basad, having less protrusive hind angles, and the elytra have broader apical area. Strikingly different from that species in the structure of its aedeagus, which is depressed, sharply reflexed at the extremity of apical lobe, has a distinct convexity of lateral wall on either side of apical orifice, and bears a compact left proximal teeth-patch inside the inner sac.

Colour as in *T. applanatus*, but the appendages are usually lighter. Head similar to that of *T. applanatus*; mentum tooth large and usually bifid; antennae reaching the middle of elytra in ♂, usually somewhat shorter than that in ♀. Pronotum transverse subcordate, wider than long, and widest at about two-thirds from base; PW/HW 1.39–1.48 (M 1.44), PW/PL 1.14–1.20 (M 1.18), PW/PA 1.41–1.52 (M 1.47), PW/PB 1.29–1.34 (M 1.32); sides strongly arcuate in front, distinctly but not deeply sinuate at about one-fifth from base, and then usually subparallel towards hind angles (though sometimes gently divergent and rarely somewhat convergent); apex either straight or slightly emarginate, with front angles a little produced and narrowly rounded; base slightly emarginate, always wider than apex, PB/PA 1.07–1.15 (M 1.12); hind angles more or less sharp, though not particularly protrusive in many cases, rarely rectangular or even somewhat obtuse; other pronotal features as in *T. applanatus*. Elytra oblong-oval and moderately convex, widest at about middle, and equally narrowed towards bases and towards apices; EW/PW 1.49–1.61 (M 1.54), EL/EW 1.57–1.63 (M 1.60); sides feebly and evenly arcuate from behind shoulders to near apices, which are widely rounded, forming a re-entrant angle at suture; other elytral features as in *T. applanatus*. Legs similar to those in *T. applanatus*.

Male genital organ large and heavily sclerotized. Aedeagus about three-sevenths as long as elytra, hardly arcuate, and widely membraneous on the dorsal surface; lateral walls abruptly reduced behind middle, and moderately convex at the base of apical lobe; basal part elongate and strongly bent towards the ventral side, with rather small basal orifice, the sides of which are deeply emarginate; sagittal aileron heavily sclerotized though sometimes very narrow; apical lobe long subtriangular, narrow but less flattened at the terminal part than in *T. applanatus*, inclined to the left, and evidently reflexed at the extremity, with minute tubercles at the terminal portion; ventral margin almost straight at middle or slightly, though widely, emarginate in lateral view. Inner sac armed with a round patch of large, heavily sclerotized teeth just before middle, a small patch of rather poorly sclerotized teeth or scales at the right dorsal side just inside apical orifice, and a lamellar copulatory piece on the right side at about middle; copulatory piece somewhat spatulate, asymmetric, becoming membraneous towards base, with the left apical (ventro-apical) corner produced into a short lobe; proximal teeth-patch not sigmoidally curved, extending from left lateral to dorsal; another small patch of minute, poorly sclerotized teeth present behind the large teeth-patch. Styles fairly elongate, left style being obviously larger than the right, each provided with four, rather long setae at apex.

Type-series. Holotype: ♂, 7–VIII–1968, G. KISHIDA leg. (NSMT). Allotype: ♀, (Yakumogahara, 920–940 m alt.), 25–VII–1978, S. KASAHARA leg. (NSMT). Para-

types: 1 ♂, 1 ♀, 10-V-1964, N. OHTANI leg. (NSMT & TS); 1 ♂, 5-IX-1964, N. OHTANI leg. (NSMT); 1 ♂, (Kitahira-tôgé, 950 m alt.), 17-IX-1977, S. MORITA leg. (NSMT); 2 ♂♂, 1 ♀ (all teneral), (Yakumogahara, 920-940 m alt.), 29-VI-1978, S. KASAHARA leg. (NSMT).

Type-locality. Mt. Hira-san (including Kitahira-tôgé and Yakumogahara), 920-950 m alt., of the Hira Mountains in Shiga Prefecture, Central Japan.

Further specimens examined. 4 ♂♂, 3 ♀♀, Tsunogawa Mine, Tsunogawa, Imazu-chô, Shiga Pref., 10-VI-1980, S. UÉNO & Y. NISHIKAWA leg. (NSMT); 1 ♂, Shiraishi-no-ana Cave, Shiraishi, Onyû, Obama-shi, Fukui Pref., 3-XI-1952, R. YOSII leg. (NSMT); 2 ♂♂, 1 ♀, same cave, 2-VIII-1954, S. UÉNO leg. (NSMT); 2 ♂♂, 4 ♀♀, same cave, 10-VI-1980, S. UÉNO & Y. NISHIKAWA leg. (NSMT).

Notes. This new species shows the first stage of evolution in the line towards *T. ohshimai* and *T. gracilior*, since its aedeagus is distinctly reflexed at the tip of the apical lobe and indicates a trend of reduction of lateral walls, which have a convexity on either side of the apical orifice. It seems to have been derived from an ancestor like *T. applanatus* and *T. canalatus*, but to have diverged from the line leading to *T. mahoae* through *T. angulicollis* and *T. rotundipennis*.

Trechiana brevior seems to have a rather wide range in the hilly area northwest of Lake Biwa-ko. Its type-locality is the northern part of Mt. Hira-san, about 10 km north by east of Kurihara and about 11 km east by north of Daihi-zan, both of which harbour *T. angulicollis*. Unlike the latter species, *T. brevior* is an inhabitant of higher places (above 900 m in altitude), at least on Mt. Hira-san whose highest point attains 1,214 m above sea-level. Here, the trechine is usually found from under stones in shaded gullies.

Towards the north beyond the valley of the Ado-gawa River, the distributional range of *T. brevior* extends onto the Nozaka Hills, where two subterranean populations of the species have been known. One is in an abandoned adit of a manganese mine (Tsunogawa Mine) and the other in a limestone cave (Shiraishi-no-ana Cave); the former locality is about 20.5 km distant to the north by east from the type-locality and is about 280 m in altitude, while the latter is about 23.5 km distant to the north-northwest from the type-locality, about 14.5 km to the west from the manganese mine, and only 100 m in altitude.

The Tsunogawa population consists of relatively large individuals (5.35-6.10 mm in body length), which have somewhat slender antennae but otherwise accord well with the type-series in external features. The standard ratios in these specimens are as follows: PW/HW 1.40-1.55 (M 1.47), PW/PL 1.15-1.23 (M 1.18), PW/PA 1.44-1.57 (M 1.49), PW/PB 1.25-1.34 (M 1.30), PB/PA 1.10-1.22 (M 1.15), EW/PW 1.49-1.67 (M 1.56), EL/EW 1.53-1.64 (M 1.60). The male genitalia are also very similar to those of the Hira specimens, with the exception of more regularly spatulate copulatory piece. In the specimens from Shiraishi-no-ana Cave (5.20-5.65 mm in body length), the prothorax is relatively wide at the base, but the male genitalia are perfectly identical with those of the Tsunogawa specimens. The standard ratios are as follows:

PW/HW 1.42–1.49 (M 1.45), PW/PL 1.15–1.22 (M 1.18), PW/PA 1.44–1.53 (M 1.47), PW/PB 1.21–1.30 (M 1.25), PB/PA 1.15–1.21 (M 1.18), EW/PW 1.50–1.64 (M 1.57), EL/EW 1.56–1.61 (M 1.59). At present, I prefer to refrain from recognizing new subspecies for the populations of the Nozaka Hills, since the difference between these and the type-series is by no means decisive and since intermediate populations could be discovered in the intervening area.

Tsunogawa Mine lies in a cryptomeria plantation above a narrow ravine. Its adit is short and unusually rusty for a habitat of anophthalmic trechines, though it is dug into slate. In spite of such seemingly unfavourable condition, trechine beetles occur on the banks of a narrow underground stream only several metres inside the entrance. In Shiraishi-no-ana Cave, which is open under a large outcrop of limestone on the right side of the Onyû-gawa River, *T. brevior* lives at the bottom of the first slope and in the innermost room, always under stones lying on muddy floors.

***Trechiana* (s. str.) *intermedius* S. UÉNO, sp. nov.**

[Japanese name: Yatsukusa-mekura-chibigomimushi]

(Figs. 40–42)

Length: 5.30–5.60 mm (from apical margin of clypeus to apices of elytra).

Very closely allied to *T. brevior*, from which it is hardly distinguishable by external characters alone, but the aedeagal inner armature is markedly different from that of the latter species.

Head somewhat larger than that of *T. brevior*, though structurally similar to the latter; antennae somewhat longer, reaching apical two-fifths of elytra. Pronotum and elytra also very similar to those of *T. brevior*, especially to those of the Tsunogawa specimens of that species; PW/HW 1.35–1.41 (M 1.38), PW/PL 1.13–1.18 (M 1.16), PW/PA 1.42–1.47 (M 1.44), PW/PB 1.25–1.27 (M 1.26), PB/PA 1.12–1.17 (M 1.15), EW/PW 1.59–1.61 (M 1.60), EL/EW 1.57–1.60 (M 1.59).⁴⁾ Legs as in *T. brevior*.

Male genital organ generally similar to that of *T. brevior*, though differing from the latter in the following details: aedeagus a little shorter, about two-fifths as long as elytra, with shorter apical lobe and less elongate basal bulb; sagittal aileron seemingly absent; apical lobe narrower and less reflexed at the extremity in lateral view, regularly attenuated to a blunt tip and forming a narrow triangle in dorsal view; ventral margin widely, though slightly, emarginate in profile; copulatory piece obviously smaller and much narrower, elongated subtriangular in dorsal view, strongly bent towards the ventral side, and blunt at apex; left proximal teeth-patch elongate, extending from left lateral to dorsal, and sigmoidally curved; styles relatively short and broad.

Type-series. Holotype: ♂, allotype: ♀, paratype: 1 ♂ (all teneral), 6–VII–1980,

4) In view of the immaturity of all the available specimens, the measurements were taken before the insects were dried. The standard ratios in the mounted specimens are somewhat different from those given above, due to the shrinkage of their soft integument.

S. UÉNO leg. (NSMT).

Type-locality. Yatsukusa-tôgé, 620 m alt., in Sakauchi-mura of Gifu Prefecture, Central Japan.

Notes. There is no doubt about the close relationship between this and the preceding species, as is clearly shown by the similarity of their external features as well as of their male genitalia, above all, of the shape of aedeagal apical lobe. It is, however, apparent that the differentiation of the Yatsukusa-tôgé population attains to the species level, considering that the copulatory piece has undergone a remarkable modification and that the left proximal teeth-patch has become elongated and sigmoidally curved. The present species seems to represent an intermediate stage of evolution between *T. brevior* and *T. gracilior*.

The known specimens of *T. intermedius*, unfortunately all more or less teneral, were taken in two small gullies lying side by side in a deciduous broadleaved forest 1.2 km north-northeast of the Yatsukusa-tôgé, a pass between Mt. Tsuchikura-daké and Mt. Kanakuso-daké at the northern part of the Ibuki Mountains. The locality lies about 38 km east-northeast of Tsunogawa Mine, which is the nearest known locality of *T. brevior*, about 24.5 km east-southeast of the type-locality of *T. tsurugaensis*, and about 27.5 km southwest by south of that of *T. grandicollis*. The holotype and the allotype were taken in the northern gully, from under a small muddy deposit of rock debris at the side of a narrow stream, while the paratype was found in a damp talus deposited under a low cliff on the right side of the southern gully.

***Trechiana* (s. str.) *insularis* S. UÉNO, sp. nov.**

[Japanese name: Kanmuri-mekura-chibigomimushi]

(Figs. 43–45)

Trechus (*Trechiana*) sp.: TAMU, 1956, Bull. Heian High School, Kyoto, (1), pp. 55, 72 (from the back), pl. 3, fig. 47.

Length: 5.85–6.35 mm (from apical margin of clypeus to apices of elytra).

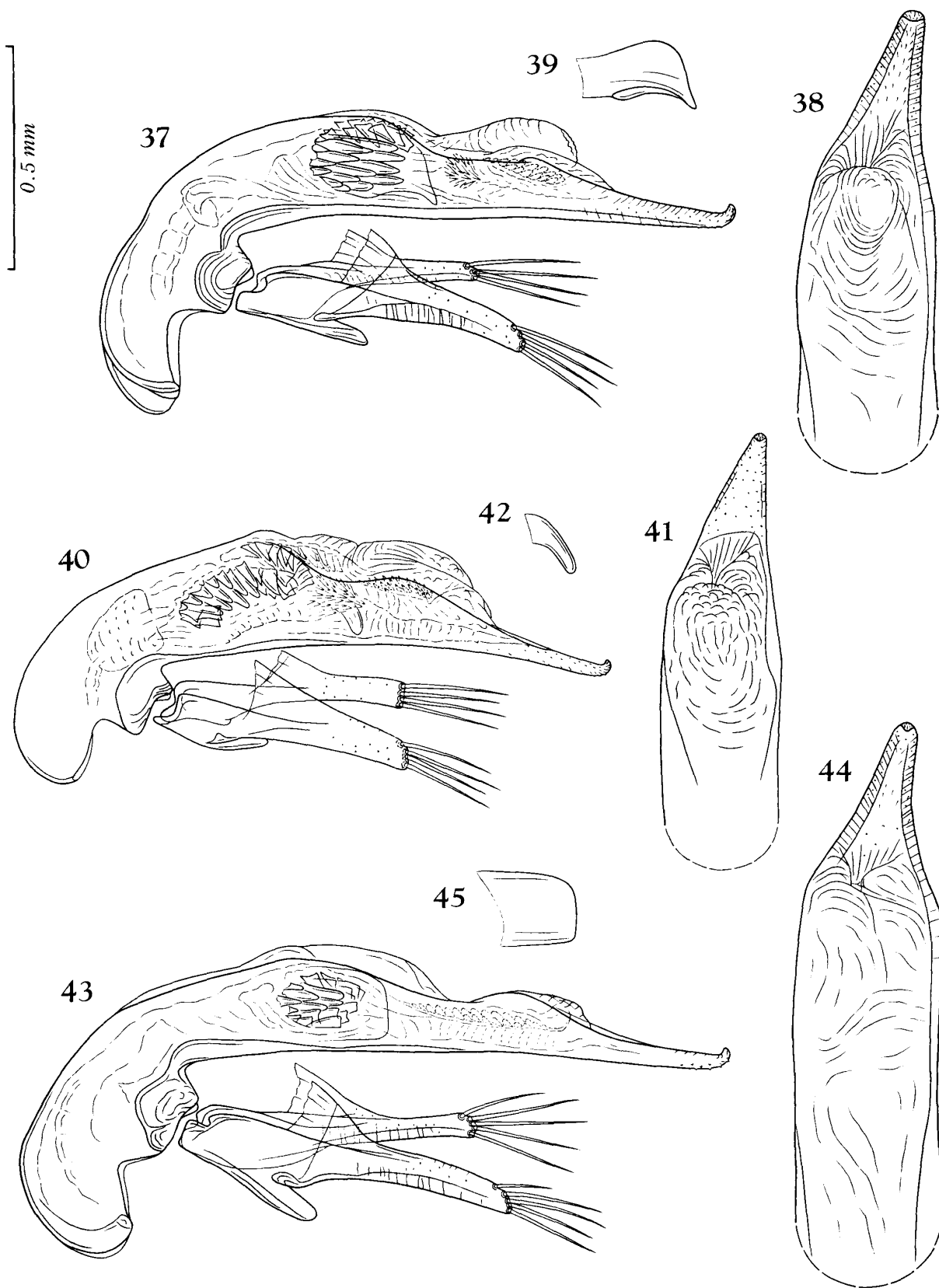
A large species related to *T. brevior*, externally distinguished from the latter by the shape of elytra, which are larger, more elongate, ampler in basal area, and have less arcuate sides. Decisively different from *T. brevior* in the structure of aedeagus, which is obviously more elongate with more reduced lateral walls, and bears a broader copulatory piece devoid of ventro-apical projection.

Head a little less transverse than in *T. brevior*, with feebly convex genae and shallow neck constriction; mentum tooth large and simple; antennae fairly long, reaching apical three-sevenths of elytra. Pronotum as in *T. brevior*, with the sides

Figs. 37–45 (on p. 239). Male genitalia of *Trechiana* (s. str.) spp.; left lateral view (37, 40, 43), apical part of aedeagus, dorsal view (38, 41, 44), and separated copulatory piece, left lateral view (39, 42, 45). — 37–39. *T. brevior* S. UÉNO, sp. nov., from Mt. Hira-san. — 40–42. *T. intermedius* S. UÉNO, sp. nov., from the Yatsukusa-tôgé. — 43–45. *T. insularis* S. UÉNO, sp. nov., from Is. Kanmuri-jima.

The Group of *Trechiana ohshimai*

239



subparallel behind the ante-basal sinuation; hind angles sharp but not produced outwards; PW/HW 1.47–1.51, PW/PL 1.17–1.24, PW/PA 1.47–1.51, PW/PB 1.33–1.34, PB/PA 1.11–1.12. Elytra larger, more elongate and broader at base than those in *T. brevior*, widest at about three-sevenths from base, and more pointed at apices than at bases; EW/PW 1.52–1.61, EL/EW 1.63–1.68; shoulders a little more salient than in *T. brevior*, with prehumeral borders less oblique; sides hardly arcuate behind shoulders, very feebly so even at middle, and rather narrowly rounded at apices behind the level of the apicalmost pore of the marginal umbilicate series, with slight preapical emargination on each side; striae superficial, only vaguely crenulate; apical striole relatively short though deep, hardly curved in front, and joining stria 5. Legs a little longer than in *T. brevior*.

Male genital organ relatively small, elongate and moderately sclerotized, basically similar to that of *T. brevior* though differing from it in the elongation of aedeagus and some other details. Aedeagus about two-fifths as long as elytra, elongate, flattened, almost straight except for the strongly bent basal part, and widely membraneous on the dorsal surface, with the lateral walls more or less reduced except for a round dorsal convexity at apical third; basal part fairly large and elongate, with relatively small basal orifice, the lateral sides of which are deeply and subangulately emarginate; sagittal aileron vestigial, extremely narrow and hyaline; apical lobe relatively short though flattened, broad at the base, narrow in apical half, inclined to the left and evidently reflexed at the extremity, which is blunt in dorsal view, with minute tubercles at the apical portion; ventral margin almost straight at middle in profile. Inner armature as in *T. brevior*, but the proximal teeth-patch is smaller and the copulatory piece is broader, with the ventro-apical corner not produced into a lobe. Styles long and slender, each bearing five apical setae which are relatively short.

Type-series. Holotype: ♂, 9–VIII–1951, N. TAMU leg. (NSMT). Allotype: ♀, 16–XI–1951, N. TAMU leg. (NSMT).

Type-locality. Island of Kanmuri-jima, on the Bay of Wakasa, in Kyoto Prefecture, Central Japan.

Notes. This is one of the largest species belonging to the group of *T. ohshimai* and is apparently endemic to the small island called Kanmuri-jima. It is evidently larger than the type-series of *T. brevior*, but the size difference between the two species is not decisive, since exceptionally large individuals occur in the subterranean populations of the latter species.

Kanmuri-jima is an uninhabited volcanic islet lying on the Bay of Wakasa of the Japan Sea. It is 8.8 km distant to the north-northwest from the nearest point (Naryû-misaki) of the mainland and though small (1,350 m long, 500 m wide, 170 m high and 0.226 km² in area), densely covered with temperate broadleaved trees. Because of its location, the islet is not readily accessible; the only biologist who had many opportunities of investigating it is TAMU, whose account is the most important contribution to our knowledge of the natural history of Kanmuri-jima. *Trechima insularis* was also discovered by him in the dense forest at the southern part of the islet (cf. TAMU,

1956, p. 82). Unfortunately, both the holotype and the allotype are not in a perfect condition of preservation, but are still useful for taxonomic study.

***Trechiana* (s. str.) *gracilior* S. UÉNO, sp. nov.**

[Japanese name: Neo-mekura-chibigomimushi]

(Figs. 46–48)

Length: 5.60–5.80 mm (from apical margin of clypeus to apices of elytra).

Very similar to *T. insularis* and indistinguishable from it by external characters alone, but the head is more transverse, the pronotum is usually a little less transverse and less contracted anteriorly, with more strongly arcuate sides, and the elytra are shorter on an average and less ample at the basal part. Confidently discriminated from that species by the structure of male genitalia: the aedeagus is much more elongate and more flattened, with longer apical lobe, the proximal teeth-patch is elongate and sigmoidally curved, and the copulatory piece has a sharply pointed ventro-apical corner.

Colour as in *T. insularis*. Head more transverse than that of *T. insularis*, with more convex genae and deeper neck constriction, but otherwise similar to the latter. Pronotum usually a little less transverse, with somewhat wider apex and more strongly and regularly arcuate sides; PW/HW 1.44–1.47 (M 1.46), PW/PL 1.14–1.18 (M 1.16), PW/PA 1.43–1.48 (M 1.46), PW/PB 1.30–1.37 (M 1.34), PB/PA 1.07–1.10 (M 1.09). Elytra usually shorter and less ample at the basal part than in *T. insularis*, widest at about middle, with the sides more regularly, though feebly, arcuate; EW/PW 1.54–1.61 (M 1.57), EL/EW 1.58–1.66 (M 1.61).

Male genital organ basically similar to that of *T. insularis*, but much more elongate and more flattened, with the aedeagal lateral walls more reduced. Aedeagus a half as long as elytra, strongly flattened and gutter-shaped, very slightly arcuate before middle and slightly turned up in apical third; lateral walls much reduced, with a distinct convexity on the left side of apical orifice but not on the right; basal bulb fairly large and moderately bent towards the ventral side, bearing heavily sclerotized sagittal aileron; basal orifice relatively small, with the sides deeply and subangulately emarginate; viewed laterally, apical lobe long, narrow and almost straight, gradually tapering towards the extremity, which is distinctly reflexed; viewed dorsally, apical lobe narrow, inclined to the left and gradually narrowed towards the blunt tip; ventral margin slightly but widely sinuate in profile. Inner sac armed with a copulatory piece and three patches of teeth or scales; copulatory piece fairly large, spatulate, with the ventro-apical corner pointed and moderately sclerotized; proximal teeth-patch composed of large, heavily sclerotized teeth, extending from left lateral to dorsal, with the apical portion sigmoidally curved on a horizontal plane; right apical teeth-patch elongate, consisting of small teeth; the third teeth-patch small, lying just behind the proximal. Styles long and slender, each bearing four apical setae which are relatively short.

Type-series. Holotype: ♂, allotype: ♀, paratype: 1 ♀, 15-X-1961, A. MATSUDA

leg. (NSMT).

Type-locality. Midori-dani, 200 m alt., in Neo-mura of Gifu Prefecture, Central Japan.

Notes. It is of special interest that this new species resembles *T. insularis* and even *T. ohshimai* not only in external morphology but also in genitalic structure, though *T. gracilior* and the latter two occur at the opposite ends of the distributional range of the species-complex. This resemblance must have resulted from a parallel evolution, since their ancestors must have dispersed in opposite directions from their native place which may have been somewhere at the eastern part of the Chûgoku Hills northwest of Lake Biwa-ko.

The Midori-dani Valley is a tributary of the Neo-gawa River that empties into the Bay of Isé. The spot where the known specimens of *T. gracilior* were taken is near the large fork of the valley about 24 km east by north of the Yatsukusa-tôgê, the type-locality of *T. intermedius*, and about 23 km south-southeast of Nukumi, that of *T. grandicollis*. According to MATSUDA, the collector, they were found from under stones on the banks of a stream flowing through a deciduous broadleaved forest. Several specimens of *Epaphiopsis matsudai*, a humicolous oculate trechine, were obtained at the same place on two occasions, but the present species has never been met again since its discovery.

***Trechiamma* (s. str.) *sigma* S. UÉNO, sp. nov.**

[Japanese name: Shima-mekura-chibigomimushi]

(Figs. 49–51)

Length: 5.35–6.05 mm (from apical margin of clypeus to apices of elytra).

Very closely allied to *T. ohshimai* and not clearly distinguished from that species by external characters alone, but the colour is darker, the microsculpture is more extensively obliterated, the pronotum has less strongly arcuate sides and less protruding hind angles, the elytra are more widely rounded at apices, and the elytral striae are shallower. Readily discriminated from *T. ohshimai* by certain details of male genitalia, above all by the following points: aedeagal lateral walls evidently less reduced, apical lobe broader and only briefly reflexed at the tip, and inner sac with heavily sclerotized left apical teeth-patch.

Colour usually dark reddish brown, more or less darker than in *T. ohshimai*, with yellowish brown appendages (except for proximal segments of antennae). Head as in *T. ohshimai*, but the labrum is less deeply emarginate at apex and the antennae are a little shorter (reaching apical four-ninths of elytra). Pronotum with smaller basal part than in *T. ohshimai*; sides less strongly arcuate in front, less deeply sinuate behind, and usually less widely divergent behind the sinuation; hind angles sharp though less protruding than in *T. ohshimai*; PW/HW 1.42–1.48 (M 1.44), PW/PL 1.08–1.15 (M 1.12), PW/PA 1.47–1.53 (M 1.50), PW/PB 1.28–1.42 (M 1.36), PB/PA 1.05–1.17 (M 1.10). Elytra less pointed at apices than in *T. ohshimai*, with the sides more regularly

arcuate from behind shoulders to a level between the two apical pores of the marginal umbilicate series; EW/PW 1.63–1.75 (M 1.67), EL/EW 1.53–1.63 (M 1.59); striae shallower, especially at the side, and a little more distinctly crenulate than in *T. ohshimai*.

Male genital organ very large and heavily sclerotized, similar in many details to that of *T. ohshimai* but differing from the latter in the following points: aedeagus obtusely bent at apical two-fifths, with the apical part straightly turned up; lateral walls obviously less reduced, though the dorsal surface of inner sac is widely exposed; apical lobe evidently broader in dorsal view, almost straight in lateral view, and only briefly reflexed at the extremity; sagittal aileron very heavily sclerotized; left apical teeth-patch composed of exceptionally well sclerotized spines forming a compact subreniform mat, which lies just posterior to the proximal teeth-patch; copulatory piece lanceolate, sharply pointed at the apex.

Type-series. Holotype: ♂, allotype: ♀, W adit, 25–V–1980, Y. NISHIKAWA, A. NOTO & S. WAKANO leg. (NSMT). Paratypes: 2 ♀♀, W adit, 25–V–1980, Y. NISHIKAWA, A. NOTO & S. WAKANO leg. (NSMT); 1 ♀, W adit, 9–VI–1980, S. UÉNO leg. (NSMT); 1 ♂ (mature), 3 ♀♀ (all teneral), E adit, 9–VI–1980, S. UÉNO & Y. NISHIKAWA leg. (NSMT).

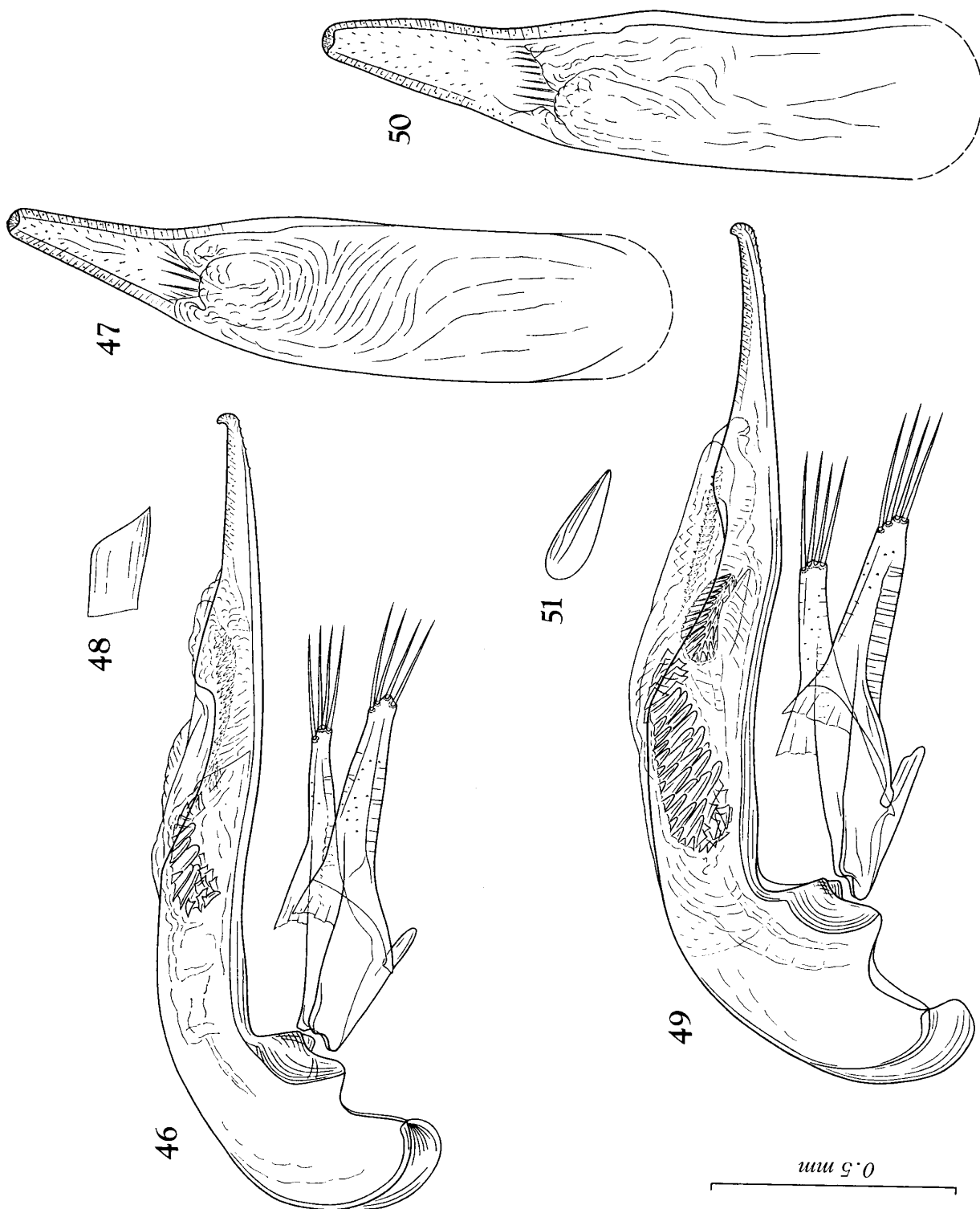
Type-locality. Shima Mine (eastern adit at Shima; western adit at Nagatani), in Miyama-chô of Kyoto Prefecture, Central Japan.

Notes. Though described as a full species in the present paper, *T. sigma* may prove to be an eastern subspecies of *T. ohshimai* when the geographical variation of the latter species becomes better known. I prefer to leave the final solution of the problem to future studies, though the genitalic difference between the two seems sufficient to ensure their specific independency.

This new trechine has so far been known from the entrance sections of two adits of a manganese mine lying on the left side of the Yura-gawa River, about 20.5 km east by north of the type-locality of *T. ohshimai* beyond the deep valleys of the Yura-gawa and the Takaya-gawa Rivers, about 12 km northwest by west of that of *T. canalatus*, and about the same distance south-southwest of that of *T. applanatus*. The adits, 500 m apart, were dug into the same formation of slate, but on slightly different levels, the eastern one at the back of farm houses about 180 m above sea-level and the western in a cryptomeria plantation at an altitude of about 230 m. Because of the loose nature of the rock, both the adits were crushed just inside the en-

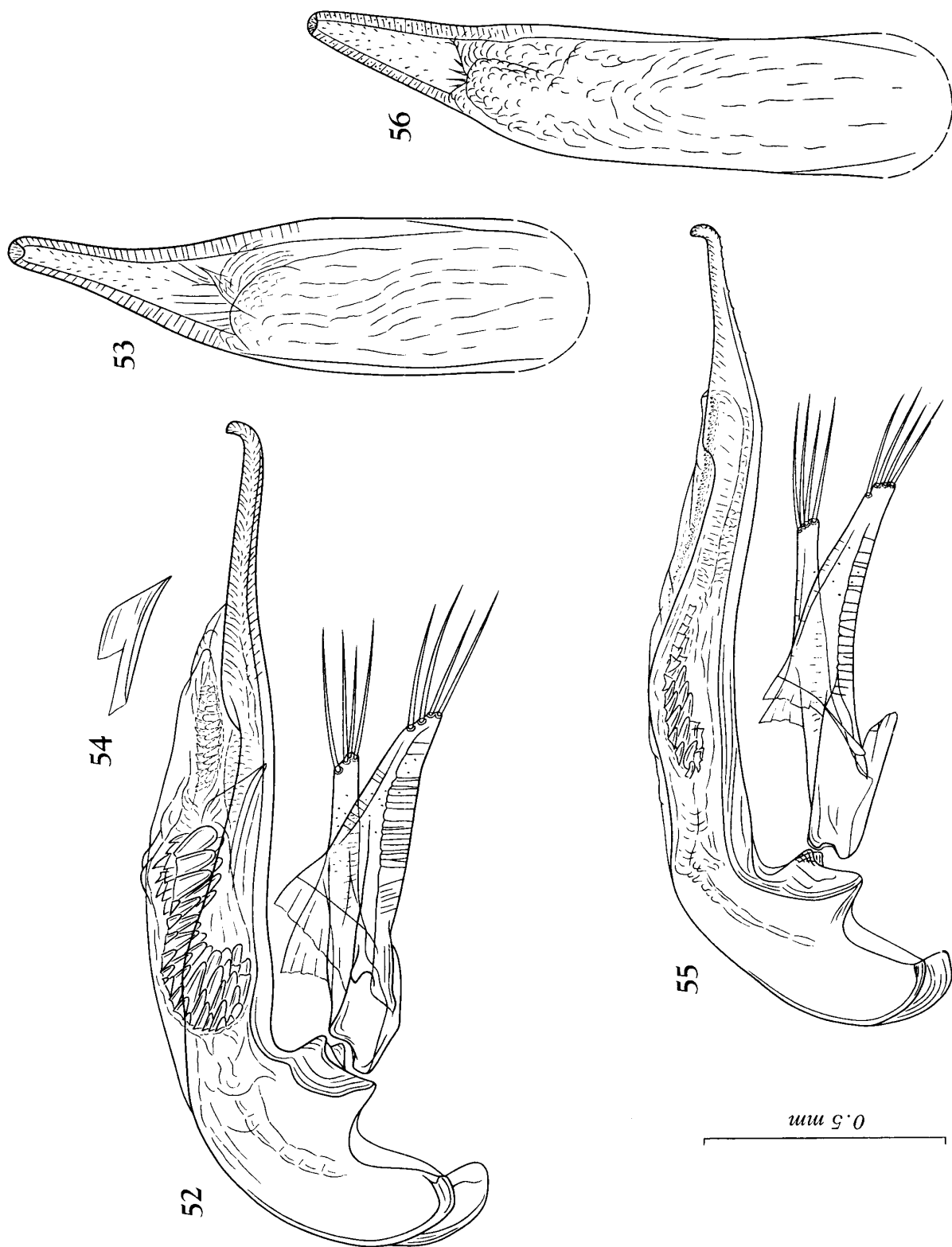
Figs. 46–51 (on p. 244). Male genitalia of *Trechiana* (s. str.) spp.; left lateral view (46, 49), apical part of aedeagus, dorsal view (47, 50), and separated copulatory piece, left lateral view (48, 51). — 46–48. *T. gracilior* S. UÉNO, sp. nov., from the Midori-dani. — 49–51. *T. sigma* S. UÉNO, sp. nov., from Shima Mine.

Figs. 52–56 (on p. 245). Male genitalia of *Trechiana* (s. str.) spp.; left lateral view (52, 55), apical part of aedeagus, dorsal view (53, 56), and separated copulatory piece, left lateral view (54). — 52–54. *T. ohshimai* (S. UÉNO), from Shizushi-dô Cave. — 55–56. *T. inermis* S. UÉNO, sp. nov., from Ogosoko.



The Group of *Trechiana ohshimai*

245



trances, leaving no dark zones accessible at present. In spite of such a seemingly unfavourable condition, *Trechiana* was found from a heap of debris in front of the entrance to the eastern adit and from under stones lying at the side of a shaded ditch leading to the western adit. Therefore, *T. sigma* is actually an endogean species, although its type-locality is assigned to Shima "Mine."

***Trechiana* (s. str.) *ohshimai* (S. UÉNO, 1951)**

[Japanese name: Yoshii-mekura-chibigomimushi]

(Figs. 52–54, 57)

Yosiitrechus ohshimai S. UÉNO, 1951, Ent. Rev. Japan, Osaka, **5**, p. 84, pl. 4, fig. A; type-locality: Shizushi Cave.

Trechus (Trechiana) ohshimai: S. UÉNO, 1953, Shin Konchû, Tokyo, **6** (11), p. 44.

Trechiana ohshimai: OHKURA & S. UÉNO, 1955, Col. Illustr. Ins. Japan, Coleopt., Osaka, rev. ed., p. 28, pl. 6, fig. 113. — NAKANE, 1963, Icon. Ins. Japon. Col. nat. ed., **2**, p. 23, pl. 12, fig. 9.

Trechiana Ohshimai: JEANNEL, 1962, Rev. fr. Ent., **29**, p. 194.

Trechiana Ohshiamai: JEANNEL, 1962, Rev. fr. Ent., **29**, p. 192. [Err.]

Trechiana (s. str.) *ohshimai*: S. UÉNO, 1976, J. speleol. Soc. Japan, **1**, p. 4, foot-note.

Length: 5.20–6.10 mm (from apical margin of clypeus to apices of elytra).

Large species of elongate body-form, recognized on the small fore-body, narrow head, strongly cordate prothorax, apically pointed elytra, and above all, the peculiarities of aedeagus which is very large and very elongate, bearing extremely reduced lateral walls, very long apical lobe with remarkably reflexed tip, and greatly developed proximal teeth-patch.

Colour relatively light reddish brown, shiny, translucent when alive; elytra, and sometimes also pronotum, weakly iridescent; palpi, scape and apical segments of antennae, epipleura, and legs pale reddish brown to yellowish brown, more or less lighter than the rest of body.

Head subquadrate, about as long as or a little longer than wide, with genae only slightly convex; surface depressed, both frons and supraorbital areas weakly convex; frontal furrows not particularly deep though clearly impressed, moderately divergent in front, widely so behind towards shallow neck constriction; neck very wide; micro-sculpture sharply impressed, largely consisting of transverse meshes; labrum transverse, with the apical margin either slightly bisinuate or simply emarginate; mandibles slender, moderately arcuate at the apical portions, with acute apices; mentum tooth variable, usually bifid but sometimes truncated or even simple; antennae long and slender, usually reaching apical two-fifths of elytra in ♂, a little shorter than that in ♀, segment 2 about four-sevenths as long as segment 3 or 4, segments 8–10 each about three times as long as wide, terminal segment evidently longer than scape but usually somewhat shorter than segment 3.

Pronotum cordate, much wider than head, a little wider than long, widest at about two-thirds from base, and rather strongly contracted in front and behind; PW/HW 1.40–1.50 (M 1.45), PW/PL 1.08–1.19 (M 1.12), PW/PA 1.42–1.54 (M 1.47),

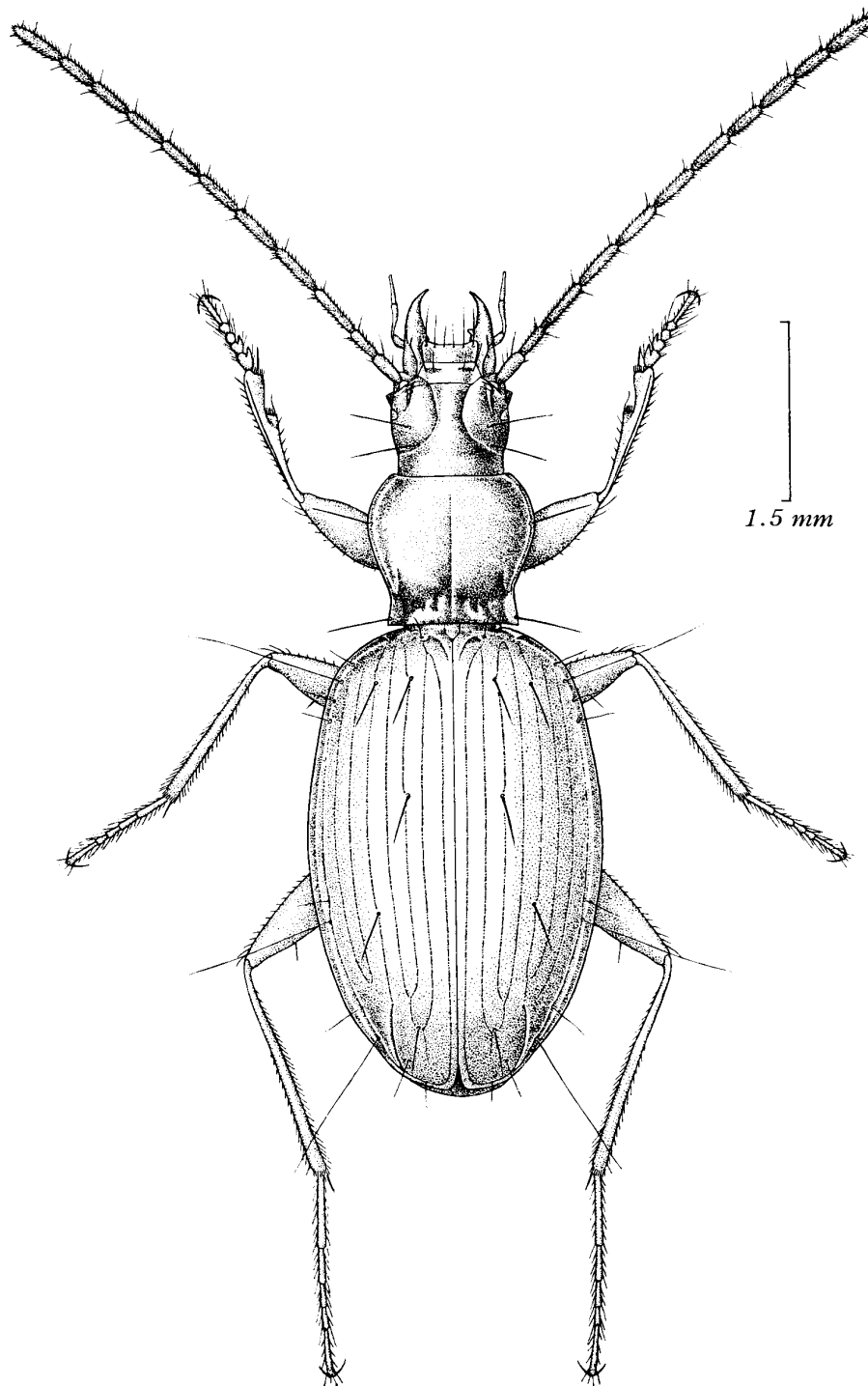


Fig. 57. *Trechiana* (s. str.) *ohshimai* (S. UENO), ♂, from Shizushi-dô Cave.

PW/PB 1.32–1.42 (M 1.35); surface convex though more or less depressed on the disc; microsculpture usually distinct though fine; sides strongly arcuate in front, deeply sinuate at a level between two-ninths and one-fourth from base, and then

more or less (usually widely) divergent again towards hind angles, which are sharp and protrude more laterad than posteriad; apex usually emarginate, with an obtuse front angle on each side, which is more or less advanced; base slightly emarginate, at least at the median part, usually a little wider than apex, PB/PA 1.01–1.14 (M 1.09); basal transverse impression continuous and deep, laterally merging into basal foveae which are deep but not particularly large.

Elytra elongated ovate and convex, much wider than pronotum, usually widest at about three-sevenths from base, and more gradually narrowed towards apices than towards bases; EW/PW 1.57–1.77 (M 1.68), EL/EW 1.53–1.64 (M 1.59); microsculpture perceptible though more or less obliterated; shoulders distinct though very obtuse, with prehumeral borders moderately oblique; sides moderately reflexed at least before middle, either almost straight or very feebly arcuate behind shoulders, gently curved at middle, and then usually very feebly arcuate again to a level between the two apical pores of the marginal umbilicate series; preapical emargination usually distinct though shallow; apices narrowly rounded, with a small re-entrant angle at suture; striae relatively deep though superficial, either smooth or very faintly crenulate, outer striae more or less shallower than the inner; scutellar striole distinct though not long; apical striole deeply impressed, short, and only feebly curved in front, usually joining stria 5 without interruption; intervals slightly convex on the disc but flat at the side; apical carina prominent, sharply keeled apicad; stria 3 with two setiferous dorsal pores situated at $1/10$ – $1/7$ and $3/10$ – $2/5$ from base respectively, stria 5 also with two setiferous dorsal pores at $1/10$ – $1/8$ and $5/9$ – $2/3$ from base respectively.

Legs long and slender.

Male genital organ very large, elongate and heavily sclerotized. Aedeagus about a half as long as elytra, almost straight except for strongly bent basal part, gutter-shaped, with widely exposed inner sac; lateral walls extremely reduced, low throughout, with a low but distinct convexity at the sides of apical orifice; viewed laterally, apical lobe very long, narrow, almost straight and not turned up, with the tip remarkably reflexed, forming a large hook; viewed dorsally, apical lobe narrowly prolonged, inclined to the left, and ending in a blunt tip; basal bulb large, with fairly large basal orifice, the sides of which are very deeply emarginate; sagittal aileron well developed and heavily sclerotized; in lateral view, ventral margin widely, though slightly, sinuate, slightly convex behind middle. Inner sac armed with a copulatory piece and two elongate patches of heavily sclerotized teeth; copulatory piece thin, asymmetrically spatulate, lying on the right side at about middle of aedeagus, with the left apical (ventro-apical) corner sharply pointed; proximal teeth-patch, consisting of exceedingly large teeth, much larger than the apical and sigmoidally curved, extending from left lateral to dorsal; apical teeth-patch almost straight, lying at the right dorsal side just inside apical orifice and consisting of smaller teeth. Styles large and elongate, right style always slender though shorter than the left, which is usually slender but sometimes fairly broad, each provided with four long setae at apex.

Type depository. Department of Zoology, National Science Museum (Nat.

Hist.), Tokyo.

Specimens examined (exclusive of topotypical ones). 2 ♂♂, Kogané-daké Hill, 400 m alt., Sasayama-chô, Hyôgo Pref., 17-V-1970, S. UÉNO leg. (NSMT).

Range. Distributed at the western part of the Tanba Highlands, though definitely known only from two isolated areas: Shizushi of Mizuho-chô in Kyoto Prefecture and Kogané-daké of the Taki Hills in Hyôgo Prefecture. At Shizushi, the trechine has been found in three limestone caves, Shizushi-dô, Shizushi-no-ko-ana and Enoki-dô, all lying close together near the headwaters of the Takaya-gawa River. On Kogané-daké Hill, it has been found on the southeastern slope in the Sasayama-gawa drainage.

Notes. *Trechiamma ohshimai*, discovered by YOSII in the autumn of 1939, is one of the anophthalmic trechines first made known from limestone caves of Japan. It is without doubt the most derivative species of the group of *T. ohshimai*, and marks the western limit of distribution of the species-group.

In former times, this trechine had been considered troglobiontic, but it was later found also in endogean habitats on Kogané-daké Hill about 13 km south by west of its type-locality. Even in the Shizushi area, in which lies the type cave, Shizushi-dô, *T. ohshimai* can be found in the twilight zones of the two smaller caves, Shizushi-no-ko-ana and Enoki-dô. The three caves are developed on slightly different levels between 350 m and 400 m in altitude; Shizushi-no-ko-ana Cave lies on the lowest level not far from a stream, while Enoki-dô Cave is at the highest position above the valley. Though no careful collectings have ever been made outside the caves in the Shizushi area, endogean populations of the trechine beetle will doubtless be found someday along the bottom of the valley.

The two known specimens from Kogané-daké Hill (718 m in height) were separately found from under large stones deeply embedded in the soil at the edges of shaded narrow streams. These are the headwaters of a river flowing southwards between the known localities of *T. yoshiakii* S. UÉNO (1978 b, p. 298, figs. 5–8), about 2 km west by north of the type-locality of the latter species and about the same distance east-northeast of Tanba Mine, another locality of the same trechine. However, the identity of the Kogané-daké specimens is unquestionable; they agree well with topotypical specimens of *T. ohshimai* excepting that the sides of elytra are more regularly arcuate. The standard ratios of their body parts are as follows: PW/HW 1.45–1.46, PW/PL 1.13–1.15, PW/PA 1.50–1.52, PW/PB 1.31–1.35, PB/PA 1.11–1.16, EW/PW 1.70–1.73, EL/EW 1.53–1.54.

An unsolved problem is the true identity of a female specimen collected by Gôji KISHIDA on Kogané-daké Hill on May 22, 1965. Though obtained at about the same spot as the collecting sites of *T. ohshimai*, this specimen has a relatively large fore-body and short depressed elytra (EL/EW 1.50). More striking is that it lacks the proximal dorsal pore of the third stria on both the elytra. It agrees well with *T. yoshiakii* and could be regarded as an aberrant individual of the latter, but none of the hitherto known specimens (more than forty) of that species have setiferous dorsal

pores on the third stria, even on one elytron. Besides, *T. yoshiakii*, which belongs to the group of *T. oni*, has never been met with until now outside mine adits. The specimen in question reminds us of *T. inexpectatus* of the fifth species-complex, especially with its peculiar elytral chaetotaxy, but it differs from the latter species in many details. At present, I am inclined to consider it to belong to *T. yoshiakii*, but of course, my view must be confirmed on the basis of ampler material.

Trechiamma (s. str.) *inermis* S. UÉNO, sp. nov.

[Japanese name: Ogosoko-mekura-chibigomimushi]

(Figs. 55–56)

Length: 5.20–6.10 mm (from apical margin of clypeus to apices of elytra).

Similar to *T. ohshimai*, but the fore-body is usually larger, the genae are more convex, the pronotum has less strongly arcuate sides and usually less sharp hind angles, the elytra are less convex, and the elytral striae are shallower. Clearly distinguished from the latter species by its aedeagus, whose apical lobe is obviously shorter and dorsally bent at the base and whose inner sac is armed only with poorly developed teeth-patches and devoid of differentiated copulatory piece.

Colour as in *T. ohshimai* though usually somewhat darker. Head more transverse than in *T. ohshimai*, with frontal furrows a little more widely distant from each other; genae more strongly and more regularly convex, with sharply marked neck constriction behind them; meshes of microsculpture more transverse, especially on frons; mentum tooth usually simple, sometimes truncated or even emarginate at the tip; antennae somewhat shorter than in *T. ohshimai*, usually reaching apical three-sevenths of elytra even in ♂. Pronotum usually less cordate than in *T. ohshimai*, with the sides less strongly arcuate in front and usually subparallel or only slightly divergent behind the ante-basal situation, which is usually shallower; hind angles less sharp than in *T. ohshimai*, sometimes almost rectangular, usually not protruding postero-laterad though individuals with rather sharply produced hind angles sometimes occur; front angles usually more blunt; microsculpture more extensively degenerated; PW/HW 1.39–1.48 (M 1.43), PW/PL 1.08–1.21 (M 1.15), PW/PA 1.41–1.55 (M 1.49), PW/PB 1.29–1.42 (M 1.35), PB/PA 1.06–1.18 (M 1.10). Elytra obviously less convex than in *T. ohshimai*, widely depressed on the disc, with a little more salient shoulders and less oblique prehumeral borders; EW/PW 1.56–1.69 (M 1.62), EL/EW 1.55–1.62 (M 1.59); microsculpture very slight; striae superficial, shallowly impressed even on the disc, weakly crenulate throughout; intervals flat even on the disc.

Male genital organ very large, elongate, though rather lightly sclerotized. Aedeagus about a half as long as elytra, strongly flattened and gutter-shaped, slightly arcuate at middle, and obtusely bent at the base of apical lobe, which is distinctly turned up with remarkably reflexed tip; lateral walls distinctly convex on each side of apical orifice; basal part relatively small, elongate, and abruptly bent towards the ventral side, bearing a narrow but heavily sclerotized sagittal aileron; basal orifice

with deeply emarginate sides; apical lobe long though evidently shorter than in *T. ohshimai*, rather wide at base and attenuated towards the reflexed tip in lateral view, inclined to the left and gradually attenuated towards the blunt tip in dorsal view; ventral margin slightly but widely emarginate before middle in profile and evidently convex at the base of apical lobe. Inner sac flat, armed with two patches of sclerotized teeth but devoid of differentiated copulatory piece; teeth-patches narrow, the left proximal one simply curved from left lateral to dorsal sides and not forming a sigmoid, the right apical one long but thin. Styles long and slender, each bearing four long setae at apex.

Type-series. Holotype: ♂, allotype: ♀, 19-VII-1980, S. UÉNO & Y. NISHIKAWA leg. (NSMT). Paratypes: 1 ♂, 1 ♀ (both teneral), 28-VI-1980, Y. NISHIKAWA leg. (NSMT); 9 ♂♂, 12 ♀♀ (incl. teneral 6 ♂♂, 5 ♀♀), 19-VII-1980, S. UÉNO & Y. NISHIKAWA leg. (NSMT).

Type-locality. Ogosoko, 260 m alt., to the southwest of Chûji in Keihoku-chô of Kyoto Prefecture, Central Japan.

Notes. This is a strange species bearing derivative and regressive (or primitive?) characters at the same time. It resembles *T. ohshimai* both in external features and in the general conformation of male genitalia, but is greatly different from that species in the structure of aedeagal inner armature. The peculiarity is above all pronounced in the absence of copulatory piece and the poor development of teeth-patches. It is difficult to decide whether the simple inner armature observed in this species is a result of regression or that of maintaining its primitive state. At least to me, however, the former view seems more convincing, since *T. inermis* is a derivative species beyond all reasonable doubt and since all the other derivative members of the species-group possess well differentiated armature in their aedeagi.

This interesting new species has so far been known only from a small gully at Ogosoko, about 1 km southwest of the village of Chûji. It is about 15.5 km south by west of Shima Mine which is the type-locality of *T. sigma*, about 9.5 km southwest of Shin-ohtani Mine, the type-locality of *T. canalatus*, and about 16.5 km west of Kibuné, one of the westernmost known localities of *T. angulicollis*. The gully lies on the eastern slope of a small hill (504 m in height) surrounded by the deep valley of the Hosono-gawa River and the main course of the Ôi-gawa River, and steeply slants down through a plantation of cryptomeria and Japanese cypress. The trechine beetle lives on the banks of a shaded narrow stream, but only in such a spot as the slope is relatively gentle. It is usually met with from under large stones deeply embedded in muddy taluses.

***Trechiana* (s. str.) *spinosus* S. UÉNO, sp. nov.**

[Japanese name: Ibuki-mekura-chibigomimushi]

(Figs. 58–60)

Length: 5.50–5.80 mm (from apical margin of clypeus to apices of elytra).

Externally similar to *T. angulicollis*, especially to such individuals as have protruding pronotal hind angles and relatively short elytra, but the fore-body is larger, the elytra are oval rather than ovate, with less salient shoulders and more oblique prehumeral borders, and the elytral surface is less convex. Radically different from that species in the structure of male genitalia, as will be described below.

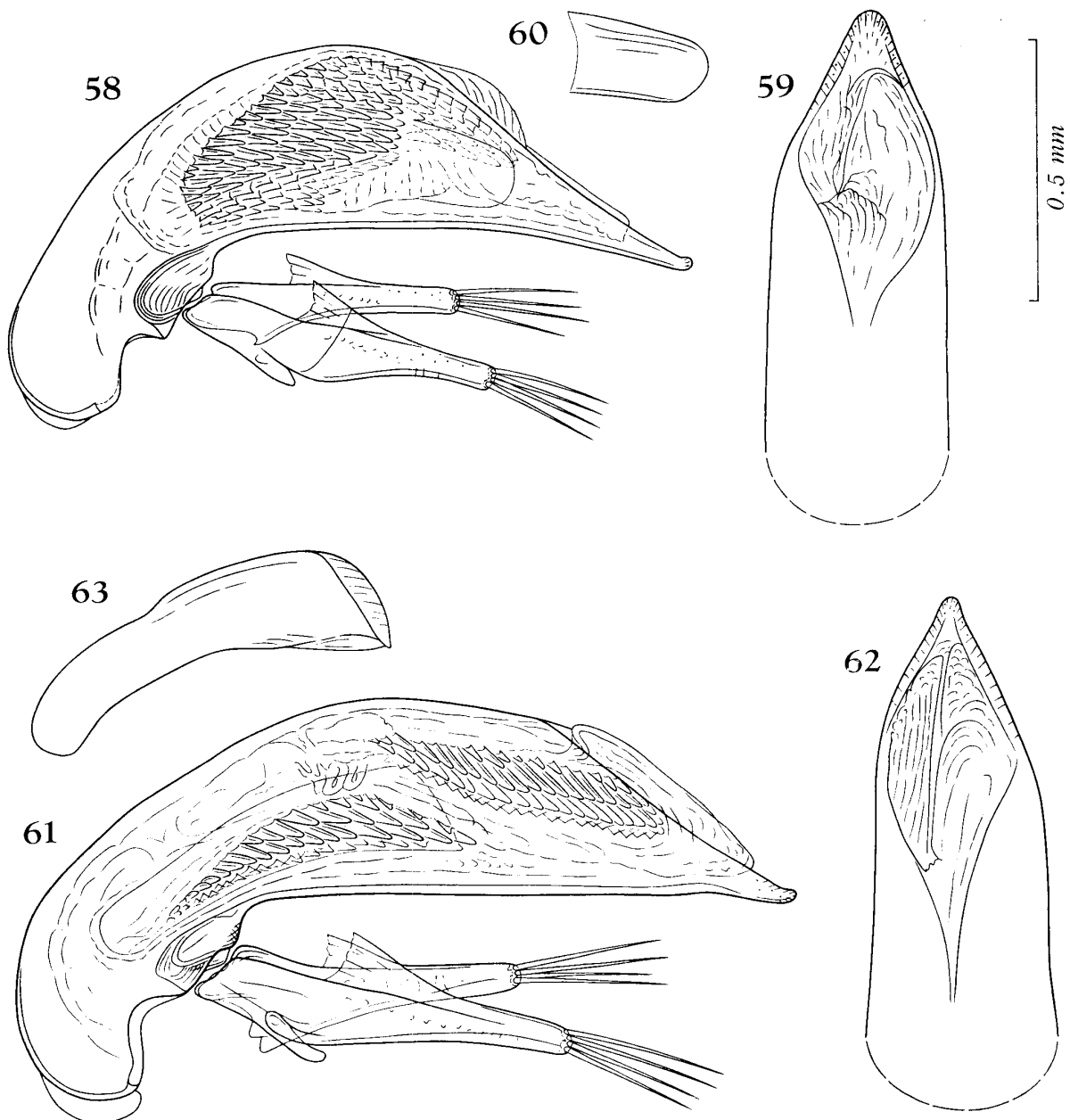
Colour as in *T. angulicollis*. Head and prothorax similar to, though larger than, those of *T. angulicollis*, with the exception of the following respects: genae less convex and antennae longer (reaching apical third of elytra) than in most specimens of the latter; pronotal hind angles always sharp, protruding postero-laterad; PW/HW 1.46–1.50 (M 1.48), PW/PL 1.15–1.21 (M 1.18), PW/PA 1.47–1.49 (M 1.48), PW/PB 1.34–1.41 (M 1.37), PB/PA 1.04–1.11 (M 1.08). Elytra oval, widest at about four-ninths from base and equally narrowed towards bases and towards apices; EW/PW 1.47–1.55 (M 1.52), EL/EW 1.48–1.56 (M 1.53); surface obviously less convex than in *T. angulicollis*, widely depressed on the disc; shoulders almost effaced, with prehumeral borders slightly arcuate and very oblique; sides more regularly arcuate from shoulders to near apices than in *T. angulicollis*; apical area wide, with subtruncated apical margins; striae deeper on the disc than in *T. angulicollis*, indistinctly crenulate; two setiferous dorsal pores on stria 3 situated at basal 1/8 or a little before that level and about 1/3 from base, those on stria 5 at basal 1/6 or a little before that level and 5/9–3/5 from base, the proximal pore on stria 5 being unusually distant from base. Legs as in *T. angulicollis*.

Male genital organ fairly large, though short and rather lightly sclerotized, surprisingly differing in shape and structure from that of *T. angulicollis*. Aedeagus about three-eighths as long as elytra, strongly convex at middle, and rapidly flattened apicad, with very short apical lobe; in lateral view, aedeagus high at middle and rapidly tapered towards the blunt tip, which is slightly turned up, with the dorsal margin semicircularly rounded at middle and the ventral margin almost straight at the same part; in dorsal view, aedeagus broad and almost parallel-sided, rather abruptly narrowed from behind the level of apical orifice, and narrowly rounded at the extremity; basal part small and narrow, moderately curved ventrad, with small basal orifice, the sides of which are deeply emarginate; sagittal aileron very small, narrow and hyaline. Inner sac armed with a very large elongate patch of heavily sclerotized teeth and a fairly large copulatory piece; teeth-patch obliquely rolled, extending from left ventro-proximal to middle dorsal and then curving down to the right apical side of inner sac, and embracing by its apical part the copulatory piece, which is spatulate and widely rounded at the apex. Styles relatively small and narrow, left style longer but not broader than the right, each bearing four apical setae.

Type-series. Holotype: ♂, allotype: ♀, paratype: 1 ♂, 20–VII–1954, R. YOSHII & G. IMADATÉ leg. (NSMT).

Type-locality. Limestone cave called Ibuki-Yasaburô-no-ana, on Mt. Ibuki-yama on the boundaries between Shiga and Gifu Prefectures in Central Japan.

Notes. In spite of the close resemblance in external morphology, this new species



Figs. 58–63. Male genitalia of *Trechiana* (s. str.) spp.; left lateral view (58, 61), apical part of aedeagus, dorsal view (59, 62), and separated copulatory piece, left lateral view (60, 63).
 — 58–60. *T. spinosus* S. UÉNO, sp. nov., from Ibuki-Yasaburô-no-ana Cave. — 61–63. *T. suzukaensis* S. UÉNO, sp. nov., from Kawachi-no-kaza-ana Cave.

has no direct relationship to *T. angulicollis*. It cannot be regarded even as a component species of the *ohshimai* complex because of the peculiarity of its male genitalia. On the other hand, it is related to *T. suzukaensis* to be described on the following pages, and together with the latter species, forms a species-complex, which is characterized mainly by the robust aedeagus with very short symmetrical apical lobe and peculiarly

developed teeth-patch(es).

The present species has been known only from a very small limestone cave lying on the northeastern slope of Mt. Ibuki-yama (1,377 m in height), which stands at the southern end of the Ibuki Mountains. The peak is about 19 km south-southeast of the Yatsukusa-tôgé, a pass at the northern part of the same mountains and the type-locality of *T. intermedius* belonging to the *ohshimai* complex. The cave, called Ibuki-Yasaburô-no-ana, is so small that the dim sunlight penetrates to its end, and lying on the bare slope, it is far from streams. In spite of such a seemingly unfavourable condition, the three known specimens of the trechine beetle were found from under stones lying in the twilight zone.

Trechiamma (s. str.) *suzukaensis* S. UÉNO, sp. nov.

[Japanese name: Suzuka-mekura-chibigomimushi]

(Figs. 61–64)

Length: 5.15–6.00 mm (from apical margin of clypeus to apices of elytra).

Externally similar to *T. brevior* of the *ohshimai* complex, but the body is evidently less convex on dorsum, the fore-body is usually a little larger, the antennae are longer, the elytra are ampler especially in apical half, with more salient shoulders and less oblique prehumeral borders, and the elytral striae are deeper. Nothing in common with *T. brevior* in the structure of male genitalia, as will be described below. From *T. spinosus*, this species can be distinguished by the pronotum with less strongly arcuate sides and less protruding hind angles, the ovate and usually less broad elytra with distinct shoulders and much less oblique prehumeral borders, the deeper elytral striae, and the larger and more elongate aedeagus bearing differently shaped inner armature.

Colour dark reddish brown to reddish brown, shiny, faintly iridescent on elytra; hind body usually a little lighter and more reddish than fore-body; palpi, apical segments of antennae, epipleura and legs light reddish brown or yellowish brown, more or less lighter than body.

Head similar to that of *T. brevior*, but the antennae are longer, always extending beyond the middle of elytra and usually reaching apical three-sevenths or two-fifths, with segments 8–10 each nearly 3.5 times long as wide; mentum tooth slightly bifid in most individuals, but sometimes simple. Pronotum as in *T. brevior*, but less convex on the disc, usually with a little longer basal part; PW/HW 1.38–1.47 (M 1.44), PW/PL 1.12–1.24 (M 1.17), PW/PA 1.40–1.51 (M 1.45), PW/PB 1.27–1.37 (M 1.30), PB/PA 1.05–1.17 (M 1.11); microsculpture more clearly impressed; sides less strongly arcuate in front, distinctly but not deeply sinuate at a level between one-fifth and two-ninths from base, and then either subparallel or slightly divergent towards hind angles (sometimes slightly convergent posteriad); hind angles usually sharp and slightly produced postero-laterad, sometimes almost rectangular and not produced laterad. Elytra ovate, ampler in apical half than in *T. brevior* and more widely rounded at apices, widest at about or slightly before middle; EW/PW 1.52–1.65 (M 1.58), EL/EW 1.52–

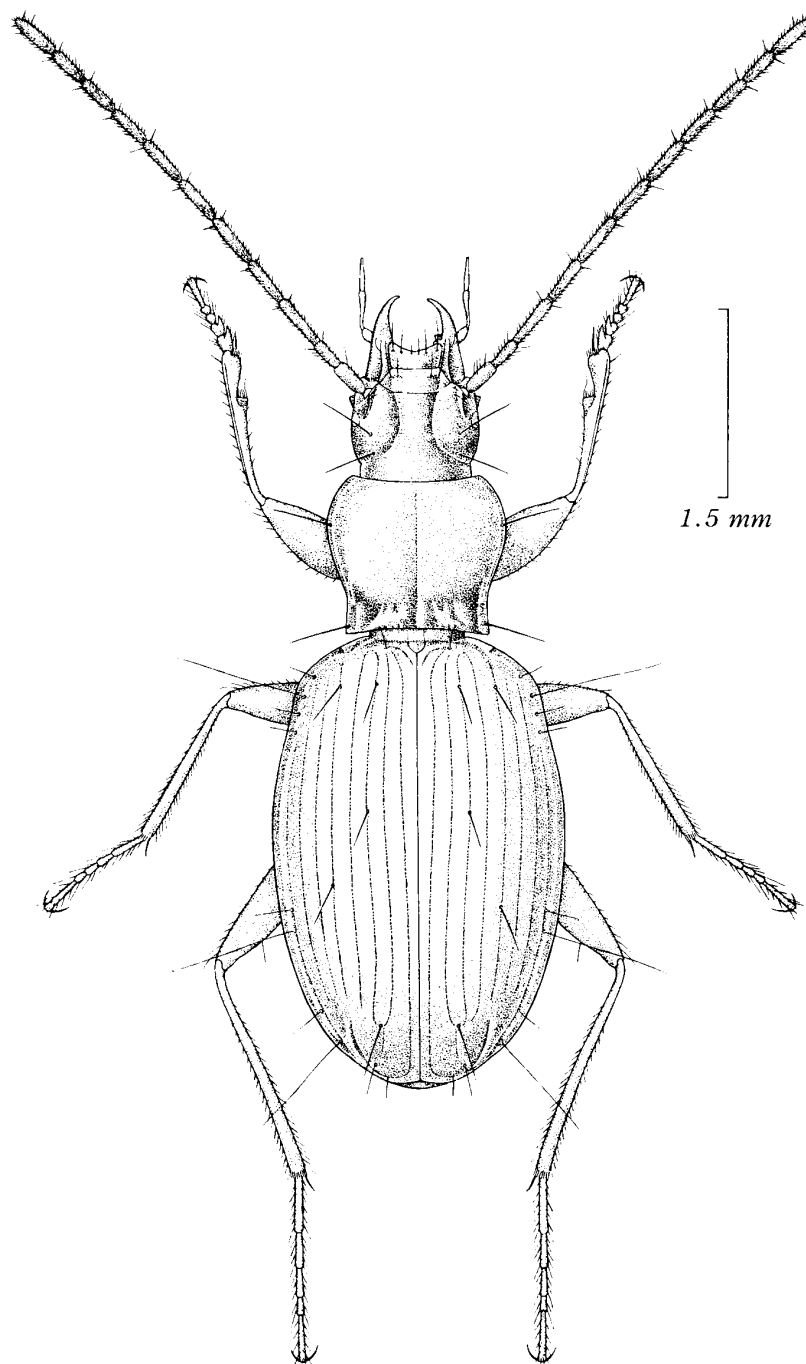


Fig. 64. *Trechiana* (s. str.) *suzukaensis* S. UÉNO, sp. nov., ♂, from Kawachi-no-kaza-ana Cave.

1.63 (M 1.57); surface widely depressed on the disc, microsculpture visible throughout though fine; shoulders distinct, with prehumeral borders slightly arcuate and not so oblique; sides rather widely reflexed, either straight or slightly emarginate behind shoulders, then feebly arcuate to the level of the seventh pore of the marginal umbilicate series; apices widely rounded without visible preapical emargination, usually forming

a small re-entrant angle at suture; striae rather deeply impressed throughout, though more or less deeper on the disc than at the side, indistinctly crenulate, scutellar striole often very short; apical striole short but deep, almost straight in front, and usually directed to stria 5; two setiferous dorsal pores on stria 3 situated at $1/10$ – $1/8$ and $3/10$ – $2/5$ from base respectively, those on stria 5 at $1/11$ – $1/8$ and about $5/9$ from base respectively. Legs as in *T. brevior*.

Male genital organ large and moderately sclerotized. Aedeagus robust, three-sevenths to four-ninths as long as elytra, convex at middle and abruptly narrowed in apical fourth, with very short symmetrical apical lobe, which is slightly turned up at the blunt extremity; basal part elongate, moderately curved ventrad, with small hyaline sagittal aileron; basal orifice with deeply emarginate sides; in lateral view, ventral margin either straight or very slightly emarginate at middle. Inner sac armed with a copulatory piece and two elongate patches of heavily sclerotized teeth; copulatory piece elongate, though only the apical portion is usually sclerotized, lying on the right side from before middle, with the ventro-apical corner pointed; both the teeth-patches lie on the left side of inner sac, one dorso-apical to the other; no right apical teeth-patch. Styles long and more or less slender, left style being longer than the right, each usually provided with four long setae at apex though a fifth seta sometimes exists on one of the styles.

Type-series. Holotype: ♂, allotype: ♀, 16–VIII–1964, S. UÉNO & K. SUGA leg. (NSMT). Paratypes: 5 ♂♂, 6 ♀♀ (incl. teneral 1 ♂), 26–VI–1955, S. UÉNO & N. KOBAYASHI leg. (NSMT); 1 ♂, 1 ♀, 4–V–1958, S. UÉNO leg. (NSMT); 8 ♂♂, 5 ♀♀ (incl. teneral 3 ♂♂, 3 ♀♀), 16–VIII–1964, S. UÉNO & K. SUGA leg. (NSMT).

Type-locality. Limestone cave called Kawachi-no-kaza-ana, at Miyamaé of Kawachi in Taga-chô, Shiga Prefecture, Central Japan.

Further specimens examined. 1 ♀ (teneral), Kôzukurano-ana Cave, Kôzukurano, Taga-chô, Shiga Pref., 8–IV–1979, A. AMAGASU leg. (NSMT); 1 ♂, same locality, 17–VI–1979, A. AMAGASU leg. (NSMT); 1 ♂, Samé-no-kômorino-ana Cave, Samé, Taga-chô, Shiga Pref., 16–IX–1974, S. YAMADA leg. (NSMT); 1 ♀, Shinodachino-kaza-ana Cave, Shinodachi, Fujiwara-chô, Mié Pref., 8–VII–1962, H. ICHIHASHI leg. (NSMT); 5 ♂♂, 1 ♀, same locality, 7–X–1973, H. IWASAKI leg. (NSMT); 8 ♂♂, 6 ♀♀, same locality, 25–VIII–1974, H. IWASAKI leg. (NSMT); 1 ♂, 3 ♀♀, same locality, 29–IV–1975, H. ICHIHASHI & A. AMAGASU leg. (NSMT); 2 ♂♂, same locality, 4–V–1975, A. AMAGASU leg. (NSMT); 3 ♂♂, 3 ♀♀ (incl. teneral 2 ♂♂, 2 ♀♀), same locality, 15–VII–1978, Y. NISHIKAWA leg. (NSMT); 1 ♂, Ohgaito-kô Mine, Ohgaito, Fujiwara-chô, Mié Pref., 3–VI–1979, A. AMAGASU leg. (NSMT); 1 ♂, same locality, 19–VI–1979, Y. TOMITA leg. (NSMT); 2 ♂♂, 2 ♀♀, Daitsû-dôkô Adit, Hatta Mine, Minamikawachi, Shinmachi, Hokusei-chô, Mié Pref., 6–II–1979, A. AMAGASU leg. (NSMT); 5 ♂♂, 10 ♀♀, same locality, 3–VI–1979, A. AMAGASU leg. (NSMT).

Notes. The type-series of this new species is more closely similar in general appearance to a member of the *ohshimai* complex than to *T. spinosus*, but it is doubtless related to the latter because of the similarity of aedeagal structure. However, the

affinity between the two does not seem very close, considering that the inner armature has achieved a unique development in each species: *T. spinosus* has only a single, very large teeth-patch that extends from the left proximal to right apical sides of the inner sac and has the copulatory piece near the apical orifice, while *T. suzukaensis* has two elongate teeth-patches on the left side alone and the copulatory piece before the middle of aedeagus. Their distributional ranges are adjacent, but are separated by the Sekigahara lowland, which must have served for a long time as a barrier against the dispersal of these trechine beetles.

Trechiana suzukaensis is rather widely distributed in the northern part of the Suzuka Mountains. This is an unusually variable species; the variation occurs both geographically and individually. Many of the specimens from the southeastern populations have large prothorax and narrow parallel-sided elytra, reminding us of *T. grandicollis* of the Etsumi Mountains or even *T. subparallelus* of the Hokuriku Province. The external difference between the two extremes of *T. suzukaensis* is much larger than that between any two species of the *ohshimai* complex. However, the relative abundance of the peculiar individuals intergrades from population to population, and no genitalic differentiation can be observed between different populations. It is possible that the trechine approaches to the subspecific stage of divergence, but I have been unable to find useful characters to divide it into two or more geographical races.

The type-locality of *T. suzukaensis* is a commercialized cave lying in the Serigawa drainage at an altitude of about 300 m on the western side of the Suzuka Mountains. It is about 19 km south-southwest of Mt. Ibuki-yama, on which lies the type cave of *T. spinosus*. The trechine beetle occurs everywhere in its main gallery, but is most frequently found on the banks of an underground stream flowing through the bottom of the first slope about 50 m removed from the entrance. This population should be noted by the rather frequent occurrence of chaetotaxially aberrant individuals; the posterior dorsal pore of the third stria is missing on one elytron in four of the twenty-eight specimens examined, and on both the elytra in one of them.

The two specimens from Kôzukura-no-ana Cave about 2 km west of the type-locality in the Serigawa drainage accord well with relatively narrow-bodied individuals from the type population. They are 5.05–5.70 mm in the length of body; the standard ratios in the mature male are as follows: PW/HW 1.41, PW/PL 1.16, PW/PA 1.48, PW/PB 1.30, PB/PA 1.14, EW/PW 1.62, EL/EW 1.63. The single known specimen, 5.70 mm in body length, from Samé-no-kô-mori-ana Cave, which is about 5 km south of the type-locality and about 250 m above sea-level, has relatively small fore-body, but otherwise agrees well with the type-series. The standard ratios are: PW/HW 1.41, PW/PL 1.12, PW/PA 1.41, PW/PB 1.28, PB/PA 1.11, EW/PW 1.68, EL/EW 1.56.

Shinodachi-no-kaza-ana Cave, about 9 km distant to the east from Samé-no-kô-mori-ana Cave, about 10 km distant to the east-southeast from Kawachi-no-kaza-ana Cave and lying at the eastern foot of the Suzuka Mountains at an altitude of 230 m, is another limestone cave from which a fairly long series of specimens of *T.*

suzukaensis has been known. They are perfectly identical with the type-series, even in the standard ratios; 5.20–6.05 mm in body length, PW/HW 1.39–1.47 (M 1.43), PW/PL 1.11–1.24 (M 1.17), PW/PA 1.39–1.49 (M 1.44), PW/PB 1.23–1.34 (M 1.28), PB/PA 1.08–1.18 (M 1.12), EW/PW 1.52–1.65 (M 1.58), EL/EW 1.51–1.60 (M 1.56).

In each of the four limestone caves mentioned above, *T. suzukaensis* coexists with a species of anophthalmic trechine. The names of those four species will be given in the Discussion at the end of the present paper.

The two specimens (5.35–5.95 mm in body length) known from Ohgaito-kô Mine, which is about 5.2 km south-southeast of Shinodachi-no-kaza-ana Cave and 250 m above sea-level, are remarkable in that the prothorax is wide at the base and has very shallow ante-basal sinuation on each side. Their facies reminds us of a species of the *subparallelus* complex, though they are identical with the type-series in aedeagal features. The standard ratios of their body parts are as follows: PW/HW 1.46–1.48, PW/PL 1.18–1.19, PW/PA 1.46–1.55, PW/PB 1.24–1.25, PB/PA 1.17–1.24, EW/PW 1.56–1.57, EL/EW 1.58–1.63.

Peculiarity of the body-form is still more pronounced in the specimens (4.95–5.85 mm in body length) from Daitsû-dôkô, an adit of a very old copper mine dug into a shale formation at about 330 m in altitude and about 3.5 km south-southwest of Ohgaito-kô, though their prothoraces are not so strangely shaped as in the Ohgaito-kô ones. Most individuals from this population are so strikingly different in facies from those of the limestone caves, that I have hesitated to include them in *T. suzukaensis*, even though their male genitalia are similar to those of the latter. However, there are other individuals identical with narrow-bodied specimens from Shinodachi-no-kaza-ana Cave, so that the Daitsû-dôkô population cannot be definitely discriminated from the others. The standard ratios in the Daitsû-dôkô specimens are as follows: PW/HW 1.44–1.50 (M 1.47), PW/PL 1.16–1.25 (M 1.19), PW/PA 1.44–1.52 (M 1.48), PW/PB 1.25–1.33 (M 1.29), PB/PA 1.12–1.18 (M 1.15), EW/PW 1.41–1.54 (M 1.47), EL/EW 1.56–1.66 (M 1.61).

Needless to say, the favourable habitats of anophthalmic trechines are not truly continuous, being separated from one another by gaps of uninhabitable areas. It is, therefore, not surprising that the southeastern populations of *T. suzukaensis* mostly consist of individuals morphologically separable from those of the northern and northwestern ones, even though they cannot be recognized as subspecies.

***Trechiana* (s. str.) *inexpectatus* S. UÉNO, sp. nov.**

[Japanese name: Sakurai-mekura-chibigomimushi]

(Figs. 65–68)

Length: 4.55–5.40 mm (from apical margin of clypeus to apices of elytra).

Not unlike *T. parvus* in general appearance, but larger and broader on an average, usually having wider base and sharper hind angles of pronotum and deeper striae on elytra. Readily distinguished from *T. parvus* and all the other members of the species-

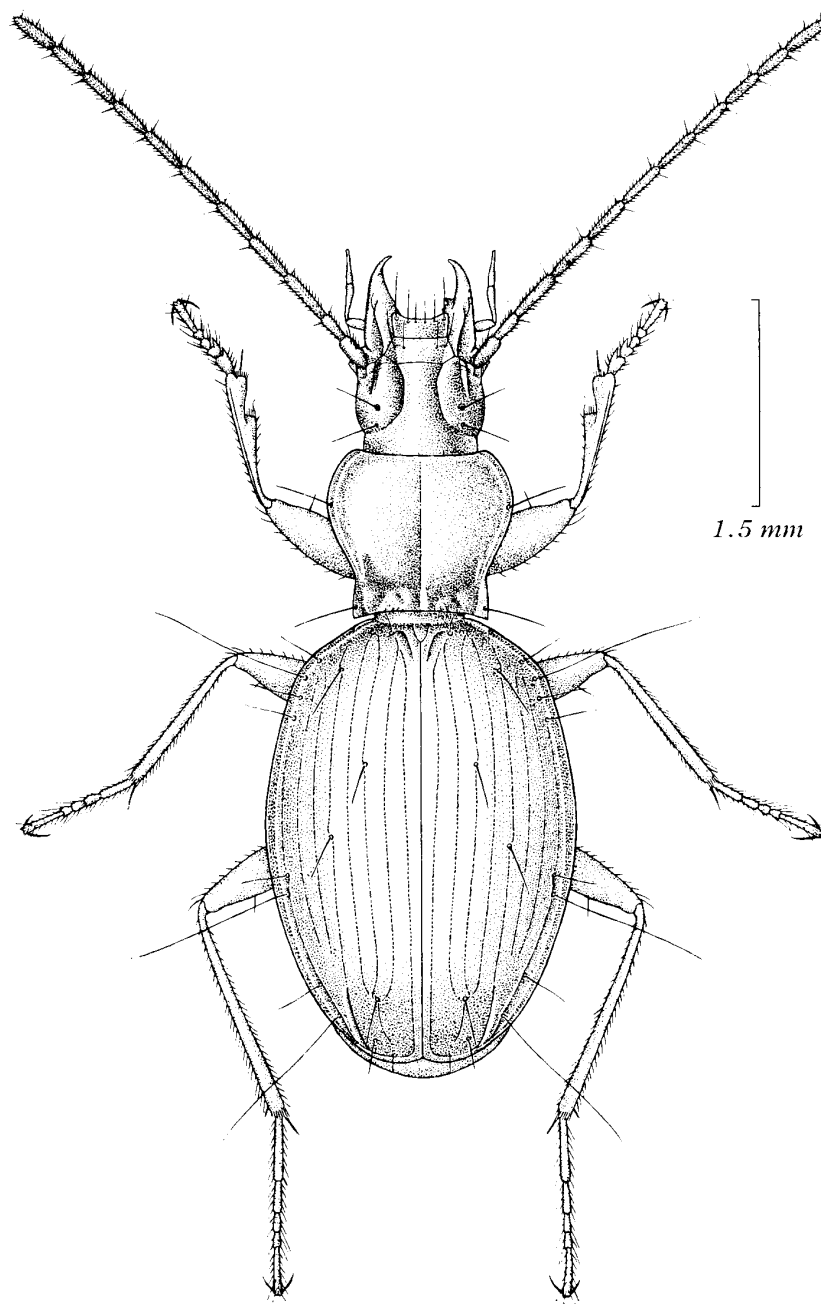


Fig. 65. *Trechiana* (s. str.) *inexpectatus* S. UÉNO, sp. nov., ♂, from the Naka-dani at Sakurai.

group by the absence of the proximal dorsal pore on elytral stria 3 and by the peculiar structure of male genitalia, which are large and robust, bearing a unique armature in the inner sac.

Body short and broad, with stout appendages. Colour dark reddish brown to reddish brown, shiny, sometimes faintly iridescent on elytra; palpi, apical half of antennae, ventral surface of hind body, and legs light reddish brown or dark yellowish

brown, more or less lighter than dorsum.

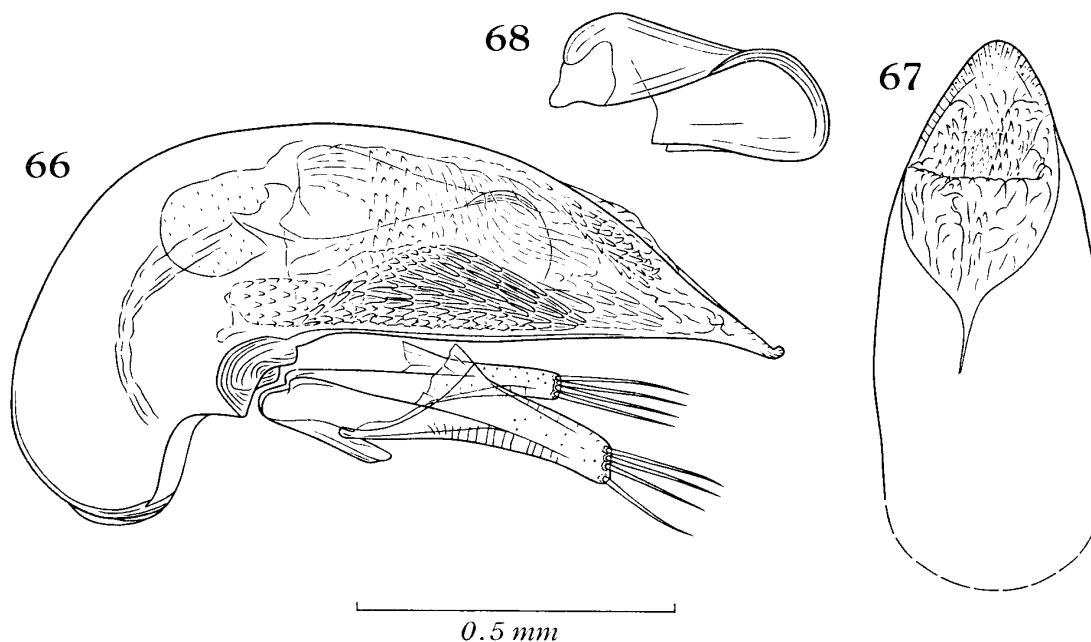
Head subquadrate, slightly wider than long; surface depressed though both the frons and supraorbital areas are moderately convex; microsculpture sharply impressed; frontal furrows deeply impressed on dorsum and moderately divergent in front and behind; genae gently and evenly convex; neck very wide, with the anterior constriction clearly marked; labrum transverse, with the apical margin widely straight at middle; mandibles slender, sharply hooked at apices; mentum tooth broad and porrect, usually simple but sometimes slightly bifid; antennae fairly stout, reaching the middle of elytra or extending a little beyond that level, with segment 2 about five-ninths as long as segment 3, which is distinctly longer than (about 1.2 times as long as) segment 4, segments 8–10 each cylindrical and more than three times as long as wide, terminal segment much longer than scape but shorter than segment 3.

Pronotum cordate, much wider than head, a little wider than long, widest at about two-thirds from base, and more rapidly narrowed anteriorly than posteriorly; PW/HW 1.40–1.48 (M 1.43), PW/PL 1.09–1.16 (M 1.14), PW/PA 1.40–1.49 (M 1.44), PW/PB 1.30–1.42 (M 1.34); surface convex, with vague transverse striations; microsculpture perceptible though partially obliterated; sides rather widely reflexed, strongly arcuate in front, less so at middle, distinctly (deeply in most specimens) sinuate at about one-fourth from base, and then more or less divergent again towards hind angles (rarely subparallel behind the ante-basal sinuation); apex very slightly emarginate, with front angles rather broad though moderately advanced; base shallowly emarginate, more or less wider than apex, PB/PA 1.02–1.15 (M 1.08); hind angles always sharp, usually produced postero-laterad but rarely only posteriorly; basal transverse impression fairly deep though not sharply defined at middle, largely included in deep basal foveae, which are more or less uneven at the bottom.

Elytra oval, much wider than pronotum, usually widest at about four-ninths from base, and equally narrowed towards bases and towards apices; EW/PW 1.61–1.71 (M 1.67), EL/EW 1.44–1.51 (M 1.47); surface convex though more or less depressed near base; microsculpture largely perceptible though obliterated here and there; shoulders almost effaced, with very oblique straight prehumeral borders; sides rather widely reflexed, moderately and evenly arcuate from shoulders to the level of the seventh pore of the marginal umbilicate series, without distinct preapical emargination; apices widely rounded, forming an obtuse re-entrant angle at suture; striae rather deeply impressed especially on the disc, weakly crenulate; scutellar striae sharply impressed though not particularly long; apical striae fairly long and feebly curved, usually joining stria 5 without interruption but sometimes joining stria 7; intervals slightly convex near suture but flat at the side; stria 3 with a single setiferous dorsal pore at $2/7-1/3$ from base, proximal pore always absent, stria 5 with two setiferous dorsal pores at $1/10-1/6$ and $1/2-3/5$ from base respectively.

Legs rather short and fairly stout.

Male genital organ large though short, and moderately sclerotized. Aedeagus about three-eighths as long as elytra, short, robust and not arcuate, with very short



Figs. 66–68. Male genitalia of *Trechiana* (s. str.) *inexpectatus* S. UÉNO, sp. nov., from the Naka-dani at Sakurai; left lateral view (66), apical part of aedeagus, dorsal view (67), and separated copulatory piece, left lateral view (68).

apical lobe and large basal bulb; dorsal margin semicircularly rounded in profile; both apical and basal orifices small, the latter being deeply emarginate at the sides; basal part rather abruptly bent ventrad, with vestigial sagittal aileron; viewed laterally, apical lobe triangular, slightly curved ventrad and dorsally tuberculate at the extreme tip; viewed dorsally, apical lobe broad, subtriangular and narrowly rounded at the extremity; ventral margin slightly convex behind middle in profile. Inner sac armed with a very large copulatory piece, two compact mats of heavily sclerotized teeth or spines, and a patch of rather poorly sclerotized teeth; copulatory piece lamellar with thickened apical margin, and rolled from left dorso-proximal to right apico-lateral; proximal teeth-mat very large, spatulate as a whole, lying on the ventral side just below copulatory piece, and composed of long spines fringed with small teeth; apical teeth-mat also spatulate as a whole, consisting of small teeth and lying just inside apical orifice; the other patch of teeth lies on the ventral side at the apical end of inner sac. Styles moderate, left style much larger than the right, each usually bearing four short setae at apex though one of the four is sometimes missing on a style.

Type-series. Holotype: ♂, allotype: ♀, 17–VII–1980, S. UÉNO & Y. NISHIKAWA leg. (NSMT). Paratypes: 1 ♂, 12–VII–1980, Y. NISHIKAWA leg. (NSMT); 5 ♂♂, 4 ♀♀, 15–VII–1980, Y. NISHIKAWA leg. (NSMT); 3 ♀♀, 17–VII–1980, S. UÉNO & Y. NISHIKAWA leg. (NSMT).

Type-locality. Naka-dani, 100–120 m alt., Sakurai of Shimamoto-chô in Osaka Prefecture, Central Japan.

Notes. This new species is unique in the elytral chaetotaxy and the aedeagal

structure, and does not seem to have any direct relationship with the other members of the species-group. It may have been derived from a common ancestor with the members of the *nagahinis* complex, but a close affinity between them cannot be detected at present. Though it may be considered to represent its own species-group, I prefer to regard the trechine as a peculiar offshoot of the group of *T. ohshimai*.

It is most unexpected that such a remarkable new species as *T. inexpectatus* occurs at the southern edge of the Nishiyama Hills, or at the southeastern corner of the distributional range of the *nagahinis* complex. Its type-locality, the Naka-dani, is a small valley running down the eastern slope of the low hill called Waka-yama (311 m in height), which marks the southern end of the Nishiyama Hills. Though imperfectly separated by the sharply curved valley of the Minasé-gawa River, this hill is the southern continuation of Mt. Ponpon-yama, which harbours *T. parvus* of the *nagahinis* complex. The type-localities of the two species are only 7 km apart in a northwest-southeast direction. It is unlikely that the two trechines coexist in some part of the Nishiyama Hills, so that the occurrence of *T. inexpectatus* should be restricted within a very narrow area.

The first specimen of this interesting trechine was discovered by NISHIKAWA as a by-product of his searches for certain species of ground-living spiders. It came out from under gravel on the bank of the shaded stream of the Naka-dani Valley. At my request, he made further searches for the trechine, and finally succeeded in locating its habitat along the upper course of the same stream. It was a muddy talus deposited along seepages just above the running water of the valley, and was well shaded by broadleaved trees. Accompanied by him, I myself paid a visit to the valley and had an opportunity to examine the collecting site. The trechine usually lived under stones deeply buried in the talus and moved about very quickly when disturbed.

Discussion

The group of *Trechiamma ohshimai* is important for several reasons. In the first place, it contains the type-species of the genus *Trechiamma*, which is the largest of all the trechine genera occurring in the Japanese Islands and which involves most complicated problems concerning zoogeography and subterranean evolution. Secondly, it is the largest group of anophthalmic trechine beetles belonging to the *Trechiamma* complex that occur on the Japan Sea side of the Japanese Islands. This genus-complex flourishes mainly on the Pacific side of Southwest Japan and attains to its maximum differentiation in the Island of Shikoku, which alone harbours more than sixty species distributed to eight different genera. On the contrary, only the members of *Trechiamma* are distributed in the inner belt (or the Japan Sea side) areas of Southwest Japan as the representatives of the genus-complex, with the exception of *Uozumitrechus* localized near the western end of Honshu (cf. UÉNO, 1958 b). Thirdly, it is the group that marks the eastern limit of distribution of the anophthalmic species of the *Trechiamma* complex on the Japan Sea side of Honshu. Beyond its distributional range,

the wide northeastern area is wholly occupied by the members of the *Trechoblemus* complex, although the distribution of anophthalmic *Trechiana* belonging to the group of *T. habei* narrowly extends northeastwards along the Pacific coast of Honshu (cf. UÉNO, 1954, 1960, 1972 b, 1974 a, etc.). It is true that an isolated anophthalmic species of *Trechiana* occurs in the northern part of the Kushigata Hills on the Japan Sea side of central Honshu (UÉNO, 1972 a), but as the beetle is a member of the group of *T. habei*, its ancestor must have reached its present habitat from somewhere on the Pacific coast across the southern part of northeastern Honshu, not from the southwest along the coastal areas of the Sea of Japan (cf. UÉNO, 1974 a, p. 106).

As was demonstrated on the foregoing pages, the trechine beetles that constitute the group of *T. ohshimai* are closely similar to one another. However, five complexes or "superspecies" can be recognized within the species-group: 1) *T. subparallelus* and *T. sasajii*, 2) *T. grandicollis*, *T. nagahinis*, *T. parvus*, *T. tsurugaensis* and *T. tenuiformis*, 3) *T. applanatus*, *T. canalatus*, *T. angulicollis*, *T. rotundipennis*, *T. mahoae*, *T. brevior*, *T. intermedius*, *T. insularis*, *T. gracilior*, *T. sigma*, *T. ohshimai* and *T. inermis*, 4) *T. spinosus* and *T. suzukaensis*, and 5) *T. inexpectatus*. The third complex can be divided into three series, that of *T. applanatus* (first two species), that of *T. angulicollis* (next three species), and that of *T. ohshimai* (remaining seven species).

The species of the first complex are characterized by the peculiarly subparallel body form and the primitive structure of male genitalia, which are very small and contain poorly developed patches of sclerotized teeth. These peculiarities are especially pronounced in *T. subparallelus*, which is considered to be the most primitive of all the known species of the group. The second complex consists of relatively small species, in which the male genitalia are usually small and short, bearing flattened but not particularly prolonged apical lobe and at least a large patch of sclerotized teeth on the left side of the inner sac. As compared with the others, this species-complex comprises rather diverse species readily discriminated on external characters alone. It may be related to the first, though the affinity between them does not appear to be so close. On the other hand, it is directly related to the third; the gap between the two is bridged to some extent by *T. tenuiformis*, whose male genitalia clearly vary towards those of the third complex.

The species that form the third complex or "superspecies" are usually large and have large elongate male genitalia, which bear remarkably prolonged apical lobe more or less modified at the tip and at least two patches of sclerotized teeth in the inner sac. The left proximal teeth-patch is particularly well developed in these species, though it doubtless corresponds with the large teeth-patch in the second complex. As was already pointed out, this complex must have been derived from the second through the extreme modification of male genitalia. The series of *T. applanatus*, in which the tip of the aedeagal apical lobe is only denticulate on the dorsal side, seems to be the most primitive of the species-complex, representing the original type, from which two lines of different types, the *angulicollis* series and the *ohshimai* series, have been derived. Though very closely related to *T. applanatus*, *T. canalatus* varies to some extent towards

the *ohshimai* series as the aedeagal lateral walls are obviously reduced. However, they lack the preapical convexity characteristic of the members of the latter series. In the species of the *angulicollis* series, the aedeagal lateral walls are complete and the tip of the aedeagal apical lobe is dorso-ventrally thickened, while in those of the *ohshimai* series, the lateral walls tend to reduce and the apical lobe is more or less distinctly reflexed at the tip. In the former, the copulatory piece has a trend of becoming narrower and thinner towards the most derivative species of the series, *T. mahoae*. In the latter series, *T. brevior* may be the most primitive, while *T. ohshimai* and *T. inermis* may be the most advanced; the other species are at different stages of evolution between the two extremes. The male genitalia become larger and more elongate in this sequence, accompanied by the reduction of the aedeagal lateral walls, which results in the wide exposure of the dorsal surface of inner sac in the advanced forms.

The fourth complex comprises relatively large species, which are characterized by the large robust aedeagus bearing very short apical lobe and one or two strikingly developed patches of large teeth. Its derivation is not certain; a possibility is that it may have been derived from the primitive stock of the species-group independent of the evolutionary line towards the *ohshimai* complex. This view is supported by the resemblance in the conformation of aedeagal tube between the first and fourth complexes and also by the occurrence of narrow-bodied individuals of *T. suzukaensis*, which look like *T. subparallelus* in general appearance. It seems possible that the narrow-bodied individuals, which appear only in the southeastern populations of *T. suzukaensis*, or in other words, at the southeastern periphery of the specific distribution, may represent the archaic type of the species. If this is actually the case, the derivation of the fourth complex can be sought in the first.

The fifth complex, so far monotypic, is widely isolated from the others both in the elytral chaetotaxy and the structure of the inner armature of aedeagus: the proximal dorsal pore on the third elytral stria is constantly lacking, and the male genitalia, which are unusually short and robust, bear a large saddle-shaped copulatory piece and two compact mats of heavily sclerotized teeth or spines, the proximal one of which is very large, spatulate, lying at the ventral position, and composed of long spines. Because of these peculiarities, the unique representative of this complex, *T. inexpectatus*, may be regarded as constituting its own species-group intermediate between the group of *T. ohshimai* and that of *T. oni*. On the other hand, however, it bears similarities to the *nagahinis* complex of the group of *T. ohshimai*, and its habitat is adjacent to those of *T. parvus* of the latter complex. In my present opinion, it had better be regarded as an offshoot of the group of *T. ohshimai*, at least for the time being.

The two species that constitute the first complex occur in the coastal areas of the Hokuriku Province and mark the northeastern limit of the distributional range of the species-group. None of the members of this complex seem to have dispersed deep into the eastern part of the Ryôhaku Mountains, whose high peaks harbour an oculate

species of the group of *Trechiamma lewisi* and whose caves are inhabited at least by a species of *Kurasawatrechus* (*K. glabriventris* S. UÉNO, 1974 b, pp. 199–202). The range of the *subparallelus* complex almost meets that of *Kurasawatrechus* also in the northeast, since *K. aberrans* occurs in a mine adit lying near the southern edge of the Hôdatsu Hills at the base of the Noto Peninsula (cf. UÉNO, 1978 a). It is probable that the coastal areas of the Hokuriku Province had been colonized by some primitive members of the species-group long before the speciation of more advanced forms took place, and that the descendants of those ancestral trechines survive in isolation until today without undergoing much modification.

That the second complex is also relatively primitive is suggested not only by morphological evidences but also by the mode of occurrence of its members. Its distribution is very discontinuous, being widely divided by the intrusion of that of the third; *T. tsurugaensis* occurs in a small limestone cave on the shore of the Bay of Tsuruga, *T. tenuiformis* in a limestone cave/mine on the northern coast of Lake Biwako, and *T. grandicollis* in an endogean habitat on the Etsumi Mountains, while the two other species, *T. parvus* and *T. nagahinis*, are restricted to the hilly area on the right side of the Yodo-gawa River. Perhaps the members of this complex had once widely spread at the eastern part of the Chûgoku Hills north and west of Lake Biwako, but were largely replaced by subsequently differentiated species of the *ohshimai* complex, and survive at present only at the northeastern and southwestern peripheries of their original range. Incidentally, the Minoo Hills which are inhabited by *T. nagahinis* also harbour *Stygiotrechus morimotoi* of the *Trechoblemus* complex, though the two species have never been found to coexist at the same spot (cf. UÉNO, 1973 a), and on Ponpon-yama, *T. parvus* coexists with another *Stygiotrechus* exactly in the same habitat.

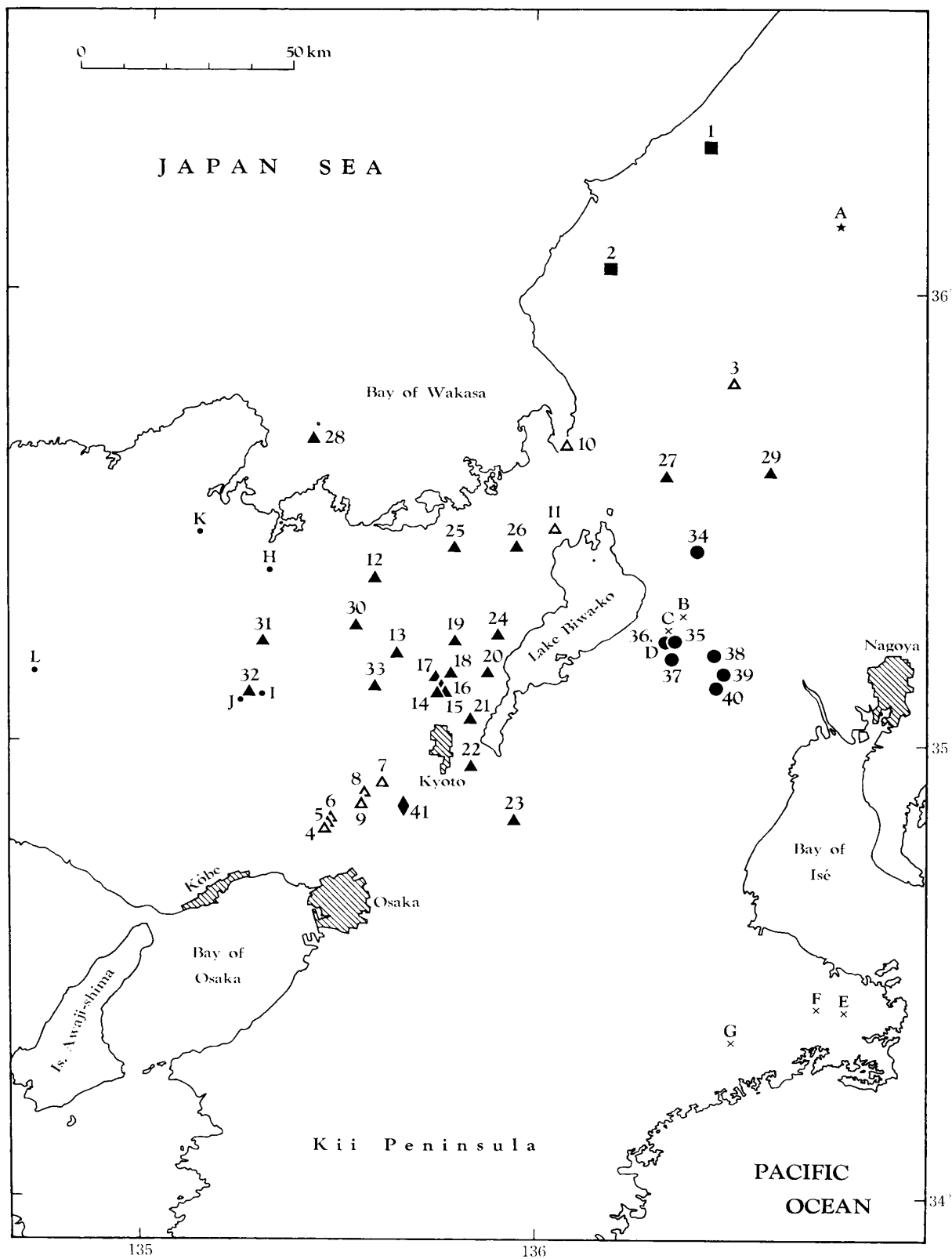
The third complex, largest and most widespread of all, is no doubt the latest derivative, as is suggested by its advanced aedeagal structure as well as by its distributional range overlying those of the others. It must have arisen from the second complex somewhere at the eastern part of the Tanba Highlands, or the eastern end of the Chûgoku Hills, and radiated from there. This view is supported by the fact that that area is not only the geographical centre of the range of the species-complex but harbours such species as *T. applanatus*, *T. canalatus*, *T. angulicollis* and *T. brevior*; the first two form the *applanatus* series and can be regarded as the most primitive components of the “superspecies”, the third is the basic form of the *angulicollis* series, and the last possesses the most primitive male genitalia in the *ohshimai* series. The other component species are evidently more derivative and the occurrence of the most advanced forms is, so far as known, always peripheral.

From the native place, the trechines of the *angulicollis* series seem to have spread mainly towards the southeast, while those of the *ohshimai* series towards the west and northeast. The latter seem to have undergone a parallel evolution, bringing about the most unusual result that *T. gracilior* is morphologically close to *T. ohshimai*. The former occurs in the Neo-gawa drainage east of the Ibuki Mountains, a locality

that is situated at the eastern end of the range of the species-complex, while the latter is distributed at the western part of the Tanba Highlands, fringing the western periphery of the range. Their localities are separated not only by a distance of more than 120 km in a bee-line, but also by the habitats of at least five other species; and yet, the two trechines are so close to each other that they could be regarded as two geographical races of the same species if they occupied adjacent areas. It seems probable that the evolutionary trend of the modification of male genitalia is orthogenetically fixed in the *ohshimai* series and that the two species have acquired similar aedeagal characters independent of each other. Also of some zoogeographic interest is the fact that a small islet lying on the Bay of Wakasa harbours an endemic species, *T. insularis*. Its ancestor must have reached the islet either on land when the sea-level was lower than it is at present, or across the sea through the agency of floods of rivers. In any case, its colonization seems to have taken place before the speciation of *T. ohshimai*, seeing that the species is obviously less derivative than the latter and is

Fig. 69. Map showing the distribution of *Trechiamma* in the Kinki District and the westernmost part of the Chûbu District in Central Japan. Species of the group of *T. ohshimai* are indicated by numerals, those belonging to the other species-groups by alphabets. ■—*subparallelus* complex; ▲—*nagahinis* complex; ▲—*ohshimai* complex; ●—*suzukaensis* complex; ◆—*inexpectatus* complex; ★—group of *T. lewisi*; ×—group of *T. habei*; •—group of *T. oni*. — 1, *T. subparallelus* sp. nov. (Awazu-onsen); 2, *T. sasajii* sp. nov. (Nanatsuoguchi-kô Mine); 3, *T. grandicollis* sp. nov. (Nukumi); 4–6, *T. nagahinis* S. UÉNO (4, mine adit at Kabaya-dani; 5, prospecting adits at Masa-no-chaya; 6, Takayama-michi); 7–9, *T. parvus* sp. nov. (7, Izuriha; 8, Tsuzuraori; 9, Ryûsen-kyô); 10, *T. tsurugaensis* sp. nov. (Kanegasaki-no-ana Cave); 11, *T. tenuiformis* sp. nov. (Manbô-no-ana Cave/Mine); 12, *T. applanatus* sp. nov. (Horikoshi-tôgê); 13, *T. canalatus* sp. nov. (Shin-ohtani Mine); 14–21, *T. angulicollis* JEANNEL (14, Kibuné; 15, Kurama-yama; 16, Oku-Kibuné, incl. Aso-dani; 17, Seryô-tôgê; 18, Hanasé-tôgê; 19, Daihi-zan; 20, Kurihara; 21, Mt. Hiéi-zan); 22, *T. rotundipennis* sp. nov. (Takatsuka-yama); 23, *T. mahoae* sp. nov. (Karaiké-tôgê); 24–26, *T. brevior* sp. nov. (24, Mt. Hira-san, incl. Kitahira-tôgê and Yakumogahara; 25, Shiraishi-no-ana Cave; 26, Tsunogawa Mine); 27, *T. intermedius* sp. nov. (Yatsukusa-tôgê); 28, *T. insularis* sp. nov. (Is. Kanmuri-jima); 29, *T. gracilior* sp. nov. (Midori-dani); 30, *T. sigma* sp. nov. (Shima Mine); 31–32, *T. ohshimai* (S. UÉNO) (31, limestone caves at Shizushi; 32, Kogané-daké Hill); 33, *T. inermis* sp. nov. (Ogosoko); 34, *T. spinosus* sp. nov. (Ibuki-Yasaburô-no-ana Cave); 35–40, *T. suzukaensis* sp. nov. (35, Kawachi-no-kaza-ana Cave; 36, Kôzukurano-ana Cave; 37, Samé-no-kômorino-ana Cave; 38, Shinodachi-no-kaza-ana Cave; 39, Ohgaito-kô Mine; 40, Daitû-dôkô Adit of Hatta Mine); 41, *T. inexpectatus* sp. nov. (Nakadani at Sakurai). — A, *T. lewisi* (JEANNEL) (Mt. Haku-san); B–D, *T. ovoideus* S. UÉNO (B, Ananoo-no-ana Pot and Taniyamadani-no-kômorino-ana Cave; C, Oori-no-tatê-ana Pot; D, Kôzukurano-ana Cave); E, *T. imadatei imadatei* (S. UÉNO et SHIBANAI) (limestone caves at Shimaji-yama); F, *T. imadatei iwatai* (S. UÉNO) (Shûrei-no-mizu-ana and Fubonjiddô Caves); G, *T. apicedentatus* S. UÉNO (Koya-no-kômorino-ana Cave); H, *T. kosugei* S. UÉNO (Magura); I–J, *T. yoshiakii* S. UÉNO (I, Tengan and Shinden Mines; J, Tanba Mine); K, *T. shuten* S. UÉNO (Oni-no-iwaya Cave); L, *T. crassilobatus* S. UÉNO (Kawakami-kô Mine and a prospecting adit at Hatagiri).

[The open triangle of No. 3 (*Trechiamma grandicollis* S. UÉNO, sp. nov.) should be replaced by a black circle, since the true affinity with the *suzukaensis* complex was recently determined. See the postscript !]



closer to *T. brevior*.

It is this species-complex that actually makes contact with the members of the group of *T. oni*. One of the latter species-group (*T. kosugei*) occurs in the Isazugawa drainage at the northwestern edge of the Tanba Highlands (UÉNO, 1955, pp. 33–34), and another (*T. yoshiakii*) in several mine adits on the Taki Hills at the western part of the same highlands (UÉNO, 1978 b, pp. 298–301). The localities of these species are at the western periphery of the range of the *ohshimai* complex, and on the Taki Hills, *T. ohshimai* itself lives in endogean habitats lying between the known localities of *T. yoshiakii*. However, this does not mean that the group of *T. oni* is directly related to the *ohshimai* complex of the group of *T. ohshimai*, since the latter is so advanced as to lose the flexibility of producing new species-groups. It must have been more primitive forms of the group of *T. ohshimai* that yielded the ancestors of the group of *T. oni*, whose original range became partly invaded by newly evolved, and dominant, species of the *ohshimai* complex. The most probable candidate for the mother stock is the ancestral forms of the *nagahinis* complex, as the existing species of this species-complex are much more variable than those of any other complexes, suggesting the potentiality of diversification in their ancestors.

Next to be considered is the fourth complex, which consists of two known species isolated at the eastern side of Lake Biwa-ko. One of them (*T. spinosus*) is restricted to the Ibuki Mountains, while the other (*T. suzukaensis*) is distributed to caves and mine adits lying in the northern part of the Suzuka Mountains. Though adjacent to each other north and south, these ranges of mountains seem to have been separated for a long time, since the two species endemic to respective mountains are widely different in the structure of aedeagal inner armature. Besides, the species-complex itself appears to have long been isolated from the others, since no other species of the group of *T. ohshimai* has achieved such a peculiar development of aedeagal inner armature as is seen in the members of this complex. As was already noted, it is not easy to trace the derivation of this species-complex on the evidences now available, though a common ancestry between this and the first complexes is suggested by some indirect clues. To make the matter worse, nothing has been known about the trechine fauna of the southern part of the Suzukas, which are largely granitic and scanty of environment favourable for the existence of endogean beetles. It is possible that certain species suggestive of the origin of this “superspecies” still remain undiscovered in such a blank area.

The northern part of the Suzuka Mountains possesses an intricate trechine fauna, five anophthalmic species having been found within an area 20 km long and 10 km wide. At the northwestern end of this area, there occurs *Trechiana ovoideus*, which is considered to be a peculiar offshoot of the group of *T. habei* (UÉNO, 1970; UÉNO & ICHIHASHI, 1979). *Trechiana suzukaensis* coexists with this species in Kôzukura-no-ana Cave lying in the Seri-gawa drainage on the western side of the mountain range. It coexists with *Ishidatrechus* (s. str.) *nitidus* in Kawachi-no-kaza-ana Cave, which is only 2 km distant to the east from Kôzukura-no-ana Cave (cf. UÉNO, 1956, pp. 72–75),

with *I. (Suzuka) kobayashii* in Samé-no-kô-mori-ana Cave, which lies about 5 km south of Kawachi-no-kaza-ana Cave (cf. UÉNO, 1956, pp. 75–78), and with *Kurasawatrechus ichihashii* in Shinodachi-no-kaza-ana Cave, which is located at the eastern foot of the mountain range and is about 9 km distant to the east from Samé-no-kô-mori-ana Cave (cf. UÉNO, 1959, pp. 300–303). The remarkable endemism of these three species, all belonging to the *Trechoblemus* complex though strikingly differing from one another, makes a sharp contrast with the wide occurrence of *T. suzukaensis*, whose distributional range covers the localities of all the other species. This situation is rather unusual, since the speciation of the trechine beetles belonging to the *Trechoblemus* complex is generally not so intensive as compared with that of the members of the *Trechiamma* complex (cf. UÉNO, 1978 c, 1979 a, p. 125). It should be noted here that the eastern side of the Suzuka Mountains is the western limit of the range of *Kurasawatrechus* and that *Ishidatrechus* is a peculiar derivative of the *Trechoblemus* complex narrowly localized on the western side of the northern part of the same mountain range. At least the members of the latter genus can be regarded as the relicts of an old fauna, while *Trechiamma suzukaensis* may be a later immigrant and more capable of range expansion. *Trechiamma ovoideus* may also be a survival of an old fauna, having been driven by *T. suzukaensis* into the northwestern corner of the Suzuka Mountain Range (cf. UÉNO & ICHIHASHI, 1979).

Trechiamma inexpectatus, the sole known species of the last complex to be considered, poses a difficult problem. It shows an intermediate state in elytral chaetotaxy between the group of *T. ohshimai* and that of *T. oni*, but is not really a missing link between the two species-groups, since the inner armature of its aedeagus has achieved a very peculiar development not found in any other known species. The trechine beetle is very narrowly localized at the southern edge of the Nishiyama Hills on the right side of the Yodo-gawa River. This locality is at the southeastern edge of the southwestern distributional range of the second species-complex, and is widely isolated from the known distributional range of the group of *T. oni* (cf. Fig. 69). At present, I cannot find any satisfactory explanation why and how such a remarkable, and relatively derivative, species as *T. inexpectatus* has been solitarily preserved in an extremely limited area under seemingly unfavourable circumstances. If by any chance certain anophthalmic *Trechiamma* are found in the hilly area on the other side of the Yodo-gawa River, we may be able to go further into a discussion on the derivation of this interesting species.

Summary

The anophthalmic trechine beetles of the group of *Trechiamma ohshimai* are classified into twenty-two species, of which nineteen are new to science and one is revived. Though closely similar to one another, these species can be divided into the following five complexes: 1) *T. subparallelus* sp. nov. and *T. sasajii* sp. nov., 2) *T. grandicollis* sp. nov., *T. nagahinis* S. UÉNO, *T. parvus* sp. nov., *T. tsurugaensis* sp. nov. and *T.*

tenuiformis sp. nov., 3) *T. applanatus* sp. nov., *T. canalatus* sp. nov., *T. angulicollis* JEANNEL, *T. rotundipennis* sp. nov., *T. mahoae* sp. nov., *T. brevior* sp. nov., *T. intermedius* sp. nov., *T. insularis* sp. nov., *T. gracilior* sp. nov., *T. sigma* sp. nov., *T. ohshimai* (S. UÉNO) and *T. inermis* sp. nov., 4) *T. spinosus* sp. nov. and *T. suzukaensis* sp. nov., and 5) *T. inexpectatus* sp. nov. The first complex seems to be the most primitive, the second the next, and the third the most advanced, while the fourth and the fifth are regarded as derivative offshoots. Reasons are given from both the morphological and zoogeographic aspects. All the species are either described or redescribed, and are also diagnosed in a key. The type designation of the genus *Trechiana* is reviewed, and the type-species is definitely settled on *Trechiana angulicollis* JEANNEL, 1954 (= *Trechus Oreas* sensu JEANNEL, 1927, nec H. W. BATES, 1883).

Postscript

After the manuscript of the present paper had been put to the press, I had an opportunity to revisit the type-locality of *T. grandicollis* sp. nov., the only described species whose aedeagal characters remained unknown. With the kind aid of Messrs. SATÔ, NISHIKAWA, HORI and IWASAKI, I made a good success not only in obtaining males of the trechine beetle from its type population, but also in finding out its second habitat at a spot about 3.8 km southeast by east of the type-locality.

To my utmost surprise, this new species turned out to be a member of the *suzukaensis* complex, though it was tentatively placed in the *nagahinis* complex on the foregoing pages (pp. 211, 263, 265, 269). Its male genitalia are basically similar to those of *T. suzukaensis*, and are markedly different from those of any component species of the *nagahinis* complex. This affinity could have been inferred from the fact that certain individuals from the southeastern populations of *T. suzukaensis* are externally very similar to *T. grandicollis* (see page 257 of this paper), but as the latter species is isolated from *T. spinosus* and *T. suzukaensis* by the eastward extension of the distributional range of the *ohshimai* complex, I failed to recognize the actual relationship between them. As was repeatedly pointed out, resemblance in facies is often deceptive among the members of the group of *T. ohshimai*, but the occurrence of narrow-bodied individuals in the peripheral populations of *T. suzukaensis* should have been regarded as a genuine sign indicating the derivation of the Suzuka species.

The realization that *T. grandicollis* belongs to the *suzukaensis* complex has brought about an interesting result: the distributional range of the species-complex is overlain by that of the *ohshimai* complex, as is also the case with that of the *nagahinis* complex. This seems to strengthen the conclusion of my discussion at least to such an extent that the *ohshimai* complex is the most derivative, and most predominant, of all the members of the species-group. It now becomes probable that the *suzukaensis* complex has been derived from either the *subparallelus* complex or a primitive form of the *nagahinis* complex and has evolved in an area to the northeast of Lake Biwa-ko independent of the other derivative ones. Its ancestor must have dispersed from north

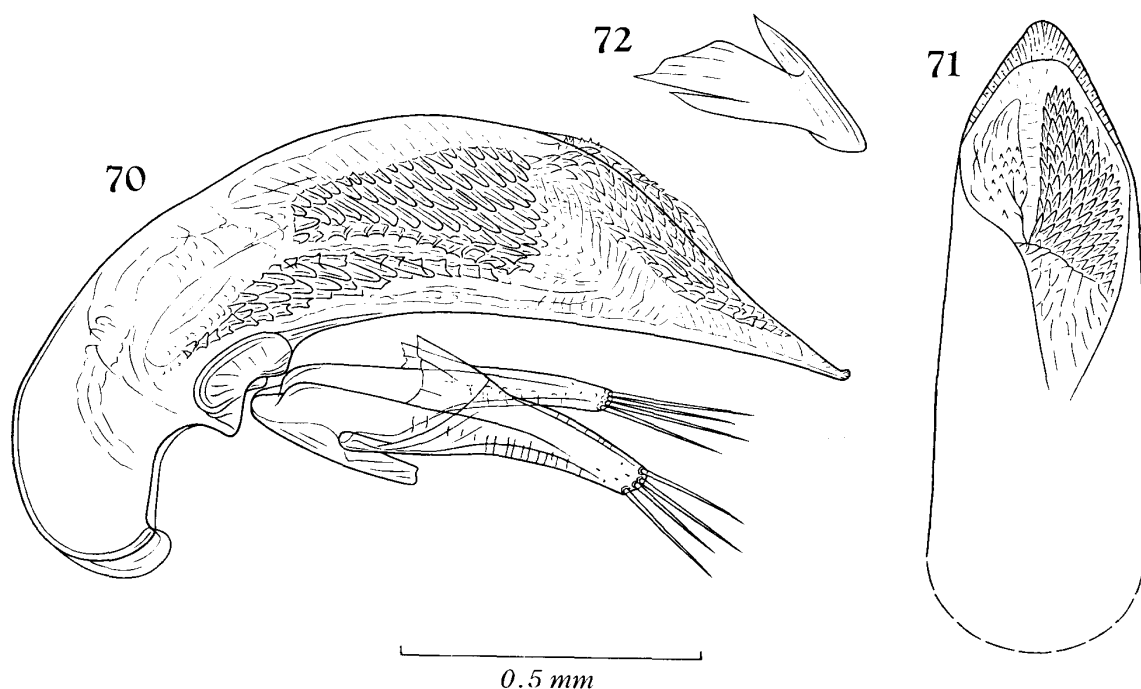
to south along the Etsumi, Ibuki and Suzuka Mountain Ranges, since all the known species that are more archaic than *T. spinosus* and *T. suzukaensis* survive now in the area at the northeastern part of the range of the species-group. Later, its original range seems to have been divided by the eastward invasion of the predominant species of the *ohshimai* complex, which resulted in the formation of the discontinuous pattern as is seen at present.

The external features of *T. grandicollis* sp. nov. were carefully described on pages 209 to 210 of this paper. It is, however, necessary to renew the quantitative data on the basis of the ampler materials and to describe the male genitalic features, as given below.

Length: 5.10–5.65 mm (from apical margin of clypeus to apices of elytra).

The standard ratios in the ten known specimens from Nukumi are as follows: PW/HW 1.41–1.47 (M 1.44), PW/PL 1.17–1.24 (M 1.20), PW/PA 1.41–1.55 (M 1.47), PW/PB 1.30–1.38 (M 1.33), PB/PA 1.06–1.13 (M 1.10), EW/PW 1.41–1.49 (M 1.45), EL/EW 1.58–1.64 (M 1.62). Those in the twenty specimens from the Nukumi-tôg  are: PW/HW 1.39–1.51 (M 1.45), PW/PL 1.15–1.25 (M 1.20), PW/PA 1.44–1.60 (M 1.52), PW/PB 1.31–1.41 (M 1.35), PB/PA 1.07–1.19 (M 1.12), EW/PW 1.40–1.51 (M 1.45), EL/EW 1.58–1.67 (M 1.64).

Male genital organ large and heavily sclerotized, markedly differing from those



Figs. 70–72. Male genitalia of *Trechiana* (s. str.) *grandicollis* S. U   , sp. nov., from Nukumi; left lateral view (70), apical part of aedeagus, dorsal view (71), and separated copulatory piece, left lateral view (72).

of *T. spinosus* and *T. suzukaensis* in the presence of three large teeth-patches on the left side of inner sac. Aedeagus about three-sevenths as long as elytra, tubular, well convex at middle with the dorsal margin semicircularly rounded in profile, rapidly narrowed in apical third in lateral view, and more abruptly so in apical fifth in dorsal view, with very short and broad apical lobe which is flat, almost symmetrical and slightly turned up at the extreme tip; apical orifice asymmetrical; basal part elongate and moderately curved ventrad, with small basal orifice, the sides of which are deeply emarginate; sagittal aileron small and hyaline; viewed laterally, ventral margin slightly emarginate at middle. Inner sac armed with three large patches of heavily sclerotized teeth on the left side and a copulatory piece at the right side of the median teeth-patch; copulatory piece fairly large though concealed by the median and apical teeth-patches, lamellar, with the dorso-apical part curved to the right and forming an elongate sclerite largely free from the main part of the piece; proximal teeth-patch elongate, narrow in lateral view, with the dorsal portion of the apical half inwardly bent and forming an elongate horizontal sheet; median teeth-patch, lying above the apical half of the proximal one, left lateral, with the ventral part curved inwards and facing the horizontal portion of proximal teeth-patch; apical teeth-patch the largest and most elongate of all, extending from the dorso-internal side of median teeth-patch to near the apical end of apical orifice, twisted at middle, and forming horizontal proximal and vertical apical portions. Styles of moderate size, left style being larger than the right, each bearing four apical setae which are not particularly long.

Supplement to the type-series. Allotype: ♂, Nukumi, 680 m alt., Ohno-shi, Fukui Pref., 4-X-1980, Y. NISHIKAWA leg. (NSMT). Paratypes: 1 ♂, 3 ♀♀, Nukumi, 680 m alt., Ohno-shi, Fukui Pref., 4-X-1980, S. UÉNO, Y. NISHIKAWA & Y. HORI leg. (NSMT); 6 ♂♂, 14 ♀♀, Nukumi-tôgé (ESE slope), 950 m alt., Neo-mura, Gifu Pref., 4-X-1980, S. UÉNO, Y. NISHIKAWA & Y. HORI leg. (NSMT).

Additional notes. The Nukumi specimens were taken exactly at the same spot as those of the original type-series, though the small cascade feeding the talus deposit of their habitat completely dried up at the beginning of October.

The Nukumi-tôgé specimens were taken along a shaded narrow gully in a beech forest on the east-southeastern slope of the Nukumi-tôgé (1,025 m in height), a pass on the Etsumi Mountains about 3.5 km southeast by east of the type-locality. Most of them were dug out from muddy deposits of fist-sized stones forming the side walls of the gully, though several isolated individuals were also met with under dead leaves accumulated at the edges of the stream. They accord well with the Nukumi specimens in both the external and genitalic features.

In one of the paratypes from the Nukumi-tôgé, the ninth and tenth segments of each antenna are fused together, forming a long arcuate segment on either side. Such an abnormality as this is very rarely met with in trechine beetles, although abnormalities of antennal segments occur rather frequently in certain groups of Coleoptera.

References

- BATES, H. W., 1883. Supplement to the geodephagous Coleoptera of Japan, chiefly from the collection of Mr. George LEWIS, made during his second visit, from February, 1880, to September, 1881. *Trans. ent. Soc. London*, **1883**: 205–290, pl. 13, 1 folder.
- JEANNEL, R., 1927. Monographie des Trechinae. Morphologie comparée et distribution géographique d'un groupe de Coléoptères. (Deuxième livraison). *Abeille, Paris*, **33**: 1–592.
- 1953. Sur les Trechini cavernicoles du Japon. *Notes biospéol.*, **8**: 127–130.
- 1954. Trois Tréchites orientaux nouveaux. *Rev. fr. Ent.*, **21**: 10–14.
- 1962. Les Trechini de l'Extrême-Orient. *Ibid.*, **29**: 171–207.
- NAKANE, T., 1963. Harpalidae. In NAKANE *et al.*, *Iconographia Insectorum Japonicorum Colore naturali edita*, **2**: 22–54, pls. 11–27. Tokyo, Hokuryukan. (In Japanese.)
- OHKURA, M., & S.-I. UÉNO, 1955. Harpalidae. In *Coloured Illustrations of the Insects of Japan*, (Coleoptera): 25–45, pls. 6–12. Osaka, Hoikusha. (In Japanese.)
- TAMU, N., 1956. Biogeographical and ecological studies of “Kammuri-sima” Island, Japan Sea. *Bull. Heian High School, Kyoto*, (1): 1–113 (from the back), pls. 1–5. (In Japanese.)
- TSUKANO, Z., S. MIURA, K. YASUKAWA & G. MIYANAGA, 1965. On the gravity anomalies with reference to the cavities in the northwestern Asuwayama Hill, Fukui City, Central Japan. *Mem. Fac. Liber. Arts, Fukui Univ.*, (II), (15): 73–85. (In Japanese, with English summary.)
- UÉNO, S.-I., 1951. Carabid-beetles found in limestone caves of Japan. *Ent. Rev. Japan, Osaka*, **5**: 83–89, pl. 4.
- 1953. The Coleoptera of Japan [12]. *Shin Konchû, Tokyo*, **6** (11): 38–45. (In Japanese.)
- 1954. Studies on the Japanese Trechinae (II) (Coleoptera, Harpalidae). *Mem. Coll. Sci. Univ. Kyoto*, (B), **21**: 29–37.
- 1955. Ditto (IV). *Ibid.*, **22**: 29–34.
- 1956. New cave-dwelling trechids of *Kurasawatrechus*-group (Coleoptera, Harpalidae). *Ibid.*, **23**: 69–78.
- 1958 a. The cave beetles from Akiyoshi-dai Karst and its vicinities. I. A new species of the genus *Trechiana*. *Ibid.*, **25**: 39–48.
- 1958 b. Ditto. II. *Uozumitrechus*, a new group of the genus *Rakantrechus*. *Ibid.*, **25**: 49–61.
- 1958 c. The cave trechids from the central part of the Chûgoku District, Japan. I. A new species of *Trechiana* from the Taishaku limestone area. *Ibid.*, **25**: 181–184.
- 1958 d. Ditto. II. The geographical races of *Trechiana yokoyamai* S. UÉNO. *Ibid.*, **25**: 185–197.
- 1959. New cave trechids from the eastern foot of the Suzuka Mountain Range, Japan. *Ibid.*, **26**: 299–304.
- 1960. A new blind trechid found in a lava cave of Japan. *Ibid.*, **27**: 49–58.
- 1969. A new endogean *Trechiana* (Coleoptera, Trechinae) from western Honshu, Japan. *Bull. Natn. Sci. Mus., Tokyo*, **12**: 779–782.
- 1970. Occurrence of a peculiar cave species of *Trechiana* (Coleoptera, Trechinae) in the Suzuka Mountains of Central Japan. *Ibid.*, **13**: 363–372.
- 1972 a. A new endogean *Trechiana* (Coleoptera, Trechinae) from the northern side of Central Japan. *Annot. zool. Japon.*, **45**: 42–48.
- 1972 b. A new anophthalmic *Trechiana* (Coleoptera, Trechinae) found in an old mine of the Izu Peninsula, Central Japan. *Ibid.*, **45**: 111–117.
- 1972 c. Occurrence of *Trechiana* (Coleoptera, Trechinae) in northern Kyushu, Southwest Japan. *Ibid.*, **45**: 250–256.
- 1973 a. A new endogean trechine beetle from Central Japan, with notes on the Japanese species of the *Stygiotrechus* complex. *Bull. Natn. Sci. Mus., Tokyo*, **16**: 23–30.
- 1973 b. Further notes on *Awatrechus* (Coleoptera, Trechinae). *Ibid.*, **16**: 181–189.

- UÉNO, S.-I., 1974 a. The cave trechines (Coleoptera, Trechinae) of the Abukuma Hills in East Japan. *Bull. Natn. Sci. Mus., Tokyo*, **17**: 105–116, 2 folders.
- 1974 b. The *Kurasawatrechus* (Coleoptera, Trechinae) of the Mino Highlands and the adjacent areas, Central Japan. *Ibid.*, **17**: 193–204.
- 1975. Two new *Trechiana* (Coleoptera, Trechinae) from eastern Shikoku, Japan. *Ibid.*, (A), **1**: 203–212.
- 1976. A new anophthalmic *Trechiana* (Coleoptera, Trechinae) from the Minoo Hills, Central Japan. *J. speleol. Soc. Japan*, **1**: 1–7.
- 1977 a. A new anophthalmic *Trechiana* (Coleoptera, Trechinae) from copper mines in western Honshu, Japan. *Bull. Natn. Sci. Mus., Tokyo*, (A), **3**: 157–161.
- 1977 b. A revision of the Himalayan trechine beetles of the genus *Stevensius*. *Ibid.*, **3**: 245–254.
- 1978 a. A new *Kurasawatrechus* (Coleoptera, Trechinae) found in a tuff mine at the northern side of Central Japan. *Ibid.*, **4**: 69–74.
- 1978 b. Two new anophthalmic *Trechiana* (Coleoptera, Trechinae) found in non-calcareous areas of Central Japan. *Ibid.*, **4**: 293–301.
- 1978 c. New records of *Kurasawatrechus fujisanus* (Coleoptera, Trechinae). *J. speleol. Soc. Japan*, **3**: 34.
- 1979 a. New cave-dwelling trechine beetles from the eastern part of the Kii Peninsula, Central Japan. *Bull. Natn. Sci. Mus., Tokyo*, (A), **5**: 115–126.
- 1979 b. Occurrence of a new alate species of *Trechiana* (Coleoptera, Trechinae) in Taiwan. *Ibid.*, **5**: 201–206.
- & H. ICHIHASHI, 1979. A note on the distribution of *Trechiana ovoideus* (Coleoptera, Trechinae). *J. speleol. Soc. Japan*, **4**: 11.